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OBSERVATIONS ON THE SUNDEW.

BY MRS. MARY TREAT.

On the morning of July 7th, I started in search of *Drosera filiformis* and found my plant in Atlantic Co., New Jersey. It was in full bloom and growing as thick as it could well stand, on either side of an extensive cranberry plantation. This charming plant, with its pretty pink blossoms, together with the dew-like substance exuding from the glands (the glands surmount the bristles or hairs which cover the long thread-like leaves), was one of the most beautiful sights I ever beheld. From former observations I had supposed this plant caught only small insects, but now found I was mistaken; great Asilus flies were held firm prisoners, innumerable moths and butterflies, many of them two inches across, were alike held captive until they died—the bright flowers, and brilliant, glistening dew luring them on to sure death. But what is the use of this wholesale destruction of insect life? Can the plants use them? Upon examination I find that after the death of the larger insects, they fall around the roots of the plants as if to fertilize them, but the smaller flies remain sticking to the leaves.

Careful and repeated experiments during several days revealed the fact that on some days the plants work much better than on others. Whether it was the electrical condition, or amount of moisture in the atmosphere, is yet to be ascertained.

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I experimented with three species of these plants — *D. filiformis*, *D. longifolia*, and *D. rotundifolia*. I carefully removed them from all atmospheric agitation, and found they were the most active on the eleventh of July. I will therefore give the record of this day's experiments, and the state of the weather.

July 11th, thermometer stood thus — 7 A. M., 68°; 2 P. M., 79°; 9 P. M., 69°. Rain early in the morning, one-third of an inch. Wind in the morning, N. E.; 2 P. M., S. E.; 9 P. M., S. E.; with rising barometer from 29·96 to 30·05.

July 11th, 10 o'clock, A. M., I pinned some living flies half an inch from the leaves, near the apex, of *D. filiformis*. In forty minutes the leaves had bent perceptibly toward the flies. At twelve o'clock the leaves had reached the flies and their legs were entangled among the bristles and held fast. I then removed the flies three-quarters of an inch farther from the leaves. The leaves still remained bent away from the direction of the light toward the flies, but did not reach them at this distance.

Whether the action of the flies' wings may have created sufficient force to bring the leaves near enough to entangle the flies is a question I have not yet satisfactorily settled in my own mind, for dead flies did not seem to have the same power as living ones.

Fifteen minutes past ten of the same day, I placed bits of raw beef on some of the most vigorous leaves of *D. longifolia*. Ten minutes past twelve, two of the leaves had folded around the beef, hiding it from sight. Half past eleven of the same day, I placed living flies on the leaves of *D. longifolia*. At twelve o'clock and forty-eight minutes, one of the leaves had folded entirely around its victim, and the other leaves had partially folded and the flies had ceased to struggle. By half past two, four leaves had each folded around a fly. The leaf folds from the apex to the petiole, after the manner of its vernation. I tried mineral substances, bits of dry chalk, magnesia and pebbles. In twenty-four hours neither the leaves, nor the bristles had made any move like clasping these articles. I wet a piece of chalk in water, and in less than an hour the bristles were curving about it, but soon unfolded again, leaving the chalk free on the blade of the leaf.

The bristles around the edge of the leaf of *D. rotundifolia* are longer than on those of *D. longifolia*, but the leaf of the former does not fold around a fly as it does in the latter — simply the bristles curve around the object, the glands on the ends of the

bristles touching the substance, like so many mouths receiving nourishment.

Half past 10, A. M., I placed raw beef on some leaves of *D. rotundifolia;* by 1 o'clock the inner bristles were curving about it, and the longer bristles on the outer edge of the leaf were slowly curving upward. By 9 o'clock, in the evening, all the bristles of three of the most vigorous leaves were clasping the beef, almost hiding it from sight, while an equally vigorous leaf made no move like clasping a bit of dry chalk.

About 10 o'clock in the morning, I placed bits of raw apple on some of the leaves of the last named species; by 9 o'clock in the evening part of the bristles were clasping it but not so closely as the beef. By 10 o'clock next day, twenty-four hours, nearly all the bristles were curved toward it, but not many of the glands were touching it. So it would seem that these plants are really carnivorous, that they prefer, and absorb animal substances directly through their leaves. And Mr. Darwin says that by pricking a certain point in the leaf of Drosera, he can paralyze half of it, and this indicates nerves!

The following is a brief summary of the experiments.

First, with *D. filiformis.*

July 11th, 10 A. M. Pinned living flies half an inch from apex of *D. filiformis.* 10 o'clock and 40 minutes; the leaves are bent perceptibly toward the flies. 12, M., the leaves have reached the flies, and the flies' legs are entangled in the bristles and held fast by the sticky substance exuding from the glands.

Second, with *D. longifolia.*

10 o'clock and 15 minutes, A. M., I place raw beef on the leaves of *D. longifolia.* Ten minutes past 12, the leaves are folded around the beef. 11½ o'clock A. M., I place living flies on the leaves of this species. 12 o'clock and 48 minutes, P. M., one of the leaves has folded entirely around the fly. 2½ o'clock, P. M., four leaves have each folded around a fly.

Third, with *D. rotundifolia.*

10 o'clock and 35 minutes A. M., raw beef on leaves of *D. rotundifolia.* 1 o'clock, P.M., the inner bristles are curving about it, and the longer bristles on the outer edge of the leaf are slowly curving upward. 9 o'clock, P.M., all the bristles of the most vigorous leaves are clasping the beef. 10 o'clock A. M. I place bits of raw apples on the leaves. 9 o'clock P. M., part of the bristles are

clasping them. July 12th, 10 o'clock, A. M., nearly all the bristles are curving toward the bits of apple, but very few of the glands are touching them.

THE SLATES OF THE TACONIC MOUNTAINS OF THE AGE OF THE HUDSON RIVER OR CINCINNATI GROUP.*

BY PROFESSOR J. D. DANA.

In my study of the Stockbridge limestone and the associated rocks in Berkshire county, Massachusetts, I have found that the ridges are often, if not always, synclinals. They consist of the slates or schists (and sometimes quartzite) overlying the limestone; and in the downward flexures of the limestone, during the period of disturbance and metamorphism which made the mountains, the overlying beds or part of them were folded together into a compact mass which has withstood degrading agents, while the same beds in the anticlinals or upward flexures were extensively broken and have disappeared. The slate ridges are then nothing but squeezes of the slate formation between the sides of a limestone synclinal.

The Taconic mountains lie on the western border of the Berkshire limestone region; and, in general, the dip of the limestone, as well as of the Taconic slates is to the eastward, and hence the slates being underneath are seemingly the older. They are actually so, unless the Taconic ridges are also synclinals, with an eastwardly inclined axis, like some of the Berkshire mountains. Until recently I had regarded the apparent order of superposition as the true order of succession, that is, I had supposed that the limestones were newer than the Taconic slates. The conclusion seemed to be confirmed by finding at different places the slates and limestone with the same high easterly dip, the slates undermost.

But a few weeks since, on an examination of the eastern base of Mt. Washington, the highest part of the Taconic range in southwestern Massachusetts, along the road just east of the highest

* Read at the Portland Meeting of the Amer. Assoc. Adv. Science.

summit, called Mt. Everett, 2,634 feet in height above the sea, the limestone of the Sheffield plain was found to have, instead of the usual easterly dip, a *westerly* dip, and this continued up the slopes of the mountain as far as the limestone extended, about 120 feet above the plain and there the limestone was seen to pass directly beneath the slates of the mountain, these having the same dip and strike, the dip 20° to 25.° Thus the limestone was seen to descend under Mt. Washington and the slates to be the superior rock. Following along the base of the mountain northward, this dip of the Stockbridge limestone under the mountain was found to continue for nearly four miles, that is along the whole eastern front.

These facts seem to prove that the limestone of Berkshire goes under Mt. Washington and comes up in the great limestone of Copake on the west side of the Taconic range.

I might show that there are probably two close-pressed synclinals in the Mt. Washington plateau (which is four to five miles broad), with steep easterly inclined axes, and that these synclinals are synclinals of slate riding over a single broken synclinal of limestone; that, to the north of the mountain, where the mountain descends to the limestone plains of Egremont, these synclinals become separated and include an anticlinal of limestone, the limestone of the anticlinal appearing in the intermediate valley while the ridges (synclinals) are slate; and that the two synclinals have an eastwardly inclined axis, the dip being very steep to the eastward. But to explain fully would require diagrams, and I leave the details for another place.

Graylock in northwestern Massachusetts, to the east of the line of the Taconic, and 3500 feet in height, whose rocks are much like those of Mt. Washington, is described by Emmons as a synclinal; and, after a survey of the facts on the ground, observing the westerly dip of the limestones of the eastern slopes near South Adams, and the easterly dip on the western slopes near the entrance to the "Hopper," as the great central valley is called, I am satisfied that he was right. The dip at the summit and most other parts is very steep to the eastward. It appears then to be a result, like many other Berkshire Mountains, of a squeeze of the slates in a synclinal; and like Mt. Washington it is probably not a simple synclinal. It may be a double one, with the Hopper corresponding to the intermediate anticlinal, the beds of the whole

having a high dip to the eastward owing to the eastward inclination of the axis of the folds. At North Adams, in the ridge of slate just west of the village, the limestone and slate both dip eastward, there being here the north end of one of the inclined synclinals.

The making of the highest summits of the Taconic region appears thence to have depended on this doubling of the folds. It becomes exceedingly difficult in such cases to ascertain the true thickness of the slate formation.

In view, then, of the facts stated in my former article with regard to the age of the limestone and its overlying rocks, it is not easy to avoid the conclusion that *the Taconic slates are Hudson river slates*, as long since held by the Professors Rogers; and, also, that the rocks on which Prof. Emmons, in his New York Geological Report, first based his Taconic system, or out of which he devised it, are after all nothing but the Hudson river and Trenton groups, with the underlying Chazy. The Trenton limestone and Hudson River or Cincinnati groups, which properly constitute one series in American Geological History, are then *the true Taconic system*.

HINTS FOR THE PROMOTION OF ECONOMIC ENTOMOLOGY IN THE UNITED STATES.*

BY JOHN L. LECONTE, M.D.

It is indeed a most gratifying evidence of the increasing interest in the department of zoology which we cultivate, that the entomologists, now in connection with the "American Association for the Advancement of Science," are sufficiently numerous to form a separate sub-section, and enough in earnest to make the meetings of the section of value to attract our widely scattered students.

I hail with joy the opportunity of being present at this meeting, and the more so, because absence from the country has prevented me from being with you on previous occasions, when you assembled to deliberate on the means necessary for the promotion of our favorite science; to communicate to each other that which you have done of best during the year, and call on your col-

*Read at the Portland Meeting of the Amer. Assoc. Adv. Science.

leagues to rejoice with you over the gems of truth which Nature bountifully bestows on you and on all who visit with pure heart and humble mind her exhaustless treasury.

Believing, as I do, that the few days thus spent in closer communion, by those who are in sympathy in their main intellectual pursuits, should be devoted rather to mutual instruction and comparison of general views derived from our studies, than to the reading of essays on special or descriptive subjects, which sooner or later will appear in suitable places in scientific journals, I have thought it not inappropriate to give briefly some ideas suggested by a long course of investigation both in the field and in the museum, regarding the requisites for a more rapid advance of American entomology, and a more speedy development of the practical benefits which the science promises.

Before endeavoring, so to speak, to forecast the future, or to indicate those paths of research from which the most useful results may be expected, it would be well to glance at the past history of our science; so that by rapidly reviewing the steps by which progress has been made, we may be better prepared to estimate the comparative value of the agencies by which our present position has been attained.

The beginning of the American school of entomology may be considered as made in 1817 by Thomas Say, in those days the most generally instructed zoologist in the United States. Though his contributions to the literature of other departments of natural history were quite copious, yet entomology seems to have been his favorite science, and on his studies of the various orders of insects his scientific reputation must mainly rest.

At that time the text-books in entomology were mainly Fabricius, Herbst and Latreille, and the efforts of American naturalists in every branch were confined to adopting, without independent criticism, the classifications and generic determinations of their European correspondents. Biology did not exist either in name or in idea. Careful observations of a few noxious species by Prof. Peck and Dr. T. W. Harris were the slight foundation upon which the whole structure of economic entomology was to be erected.

It will be readily seen then, that the entomologists of that early period were essentially *species men*, namers and describers of the unknown objects with which they were surrounded: — a

work which was done so well that of the many hundreds of species described by Say, and the smaller number by his collaborators, scarcely any remain doubtful, and but few unknown.

Preëminent among the early naturalists of the United States, and far beyond any of them, both as an industrious collector, a careful observer in the field, and an intelligent investigator in the museum, was Dr. T. W. Harris, of Massachusetts. A man of singular modesty and diffidence, appreciated neither by himself nor by others, but whose memory will be cherished by all who knew him, and whose merits will be more and more recognized as time brings him with his limited opportunities more strongly in contrast with the other students of his day. Had he published, as he wrote, the independent investigations on classification which he made, or had the proper facilities been afforded him and the requisite stimulus given, our science in this country would have anticipated many of the schemes of arrangement developed later by the best European students.

Among the entomologists of that time, properly pertaining to our country, must be named Dr. C. Zimmermann, a German by birth, and trained to science before he made this continent his home. The monographs of *Zabrus* and *Amara*, published before leaving Europe, still remain thoroughly careful and classical studies of those genera, to which nothing has been or can be added except the descriptions of species since collected. It was a misfortune for our science that Zimmermann too, though a profound and laborious student, would never publish the results of his investigations. As a systematist in the science, he was of the very highest order, and I here cheerfully acknowledge my obligations to him for some of the hints which, afterwards more fully developed, have gained for several of my memoirs the generous approval of foreign entomologists. His manuscripts, submitted to me in 1867 by his widow, contained a large part of a systematic work on Coleoptera, with descriptions of many hundred new species of the Southern States, which, however, had been rendered of no avail by recent publications, posterior to the manuscripts in question.

After the founders of the science in this country came a period of apathy, during which nothing was done. The work of description was then resumed by Melsheimer, Ziegler and myself, without, however, any attempt at independent study of classifica-

tion or particular observation of life histories of the objects described.

The first serious monographic study made was that of the *Histeridæ*, published in 1845 by my father in the Boston Journal of Natural History, modelled on the *Monographia Histeroidum* of Paykull, and, like it, illustrated with outline figures of all the species.*

The second period in the history of American entomology now begins, in the decade from 1840–50; a most important epoch in the intellectual history of our country. An independent school of science had commenced in zoology by the investigations of James D. Dana on the polypes and crustacea collected while attached to the Exploring Expedition of Captain (now Admiral) Wilkes; in geology by James Hall of the New York Geological Survey, and by the brothers Rogers of the Pennsylvania and Virginia Surveys. Prof. Agassiz also came to us introducing methods of systematic instruction, which previously each student, after many trials, had to invent by himself, and for himself alone; and with his unequalled ability as a lecturer to excite enthusiasm in his hearers, he added a powerful stimulus to the cultivation of natural history, the effects of which can hardly be exaggerated. With few exceptions, the zoological students who have since become prominent in the United States have been instructed for a longer or shorter period by him; and it has been a frequent cause of regret to me, that my early efforts in science had not been directed by one who could so thoroughly combine kindness in instruction with firmness in criticism; who could so well temper the natural impatience for rapid publication of the young and inexperienced observer, to that calmness of judgment which permits nothing to be published until it expresses the best results which the author can at that time produce.

Another most valuable auxiliary to science in the United States, belonging to the same decade, was the establishment of the Smith-

*I have purposely excluded from this sketch of American entomology the illustrated work of Boisduval and LeConte on the Lepidoptera of North America. Although the task of collecting material and making notes on the habits of larvæ with many drawings occupied my father, Major John LeConte, for several years, the text of the work and the systematic arrangement, such as it was, were prepared abroad, not at all under his control; and the work was stopped before the completion of the first volume. All the notes and drawings which were to have been used in the study of the Heterocera were retained by his coeditor, and still remain in Europe.

sonian Institution, on a secure basis, and nearly in the form devised by its learned secretary, Prof. Joseph Henry; whereby the funds were employed chiefly in the assistance of investigators and explorers, and in the publication of scientific memoirs.

It has long been the privilege of those who labor to *extend* the boundaries of human knowledge to work hard and (in ordinary phraseology) to find themselves: and, until the organization of the Smithsonian Institution, it was their further privilege, in this country, to publish at their own individual expense all memoirs, which from bulk or cost of illustration were beyond the limited means of local scientific societies.

Under the fostering influence of this, among the most noble of the intellectual charities of the age, many valuable works on abstract science have been published; which, though produced in less than one-third of a century, by a small number of investigators, thinly dispersed over a large extent of territory, would do honor to older communities, in which students of science and their labors are not unfrequently cared for by the protecting influence of government.

It has thus come to pass that manuals and catalogues of several orders of insects have been prepared by the students best qualified to give, in a condensed form, compilations of the latest results of investigation, or entitled to put forth their own views of classification, as worthy of acceptance; and in the preparation of this series of works, valuable assistance has been rendered in orders which had not received attention from our native students, by some of the best European authorities on those subjects, among whom are specially to be remembered with gratitude Hagen, Loew, Osten-Sacken and De Saussure.

The excellence of the memoirs thus published by the Smithsonian Institution results from two facts; the persons invited to prepare the work are those who are recognized by scientific men as most competent for the labor; and the memoirs when prepared are submitted to committees capable of judging of their value. Neglect of these precautions will probably ensure greater or less failure in attempts to procure works for either primary or advanced scientific instruction; and I am the more confirmed in this opinion by the miserable result attending the munificent expenditure of the state of New York, on the volume illustrative of insects injurious to agriculture. Compiled by a person ignorant of the

science, and illustrated by a draughtsman untrained in natural history drawing, it remains a permanent example of misplaced confidence and liberality; an equal disgrace to the legislation, the science and the art, of the great state in which it was published.

The possibility of acquiring some knowledge of our insects, without the possession of large costly libraries which up to this period were indispensable, soon made the science more popular; and the names of the species beginning to be known, many persons were attracted to form collections, and others to the equally fascinating study of the life history of individual objects.

Thus arose the present condition of economic entomology; and the biological studies commenced years before by Dr. Harris were worthily continued by Dr. A. Fitch of New York, and the state entomologists afterwards appointed in several of the Western States.

Most prominent among those to whom we are indebted for the development of practical entomology was the lamented B. D. Walsh, of Rock Island, Illinois; an Englishman by birth, bringing to this country a mind well trained in classical and scientific instruction by a thorough University course, and animated by an enthusiastic love not only for science but for truth and consistency in life.

The "Practical Entomologist," a monthly magazine, published (1865 to 1867) by a committee of the entomological society of Philadelphia, was edited chiefly by him. Its successors, the "American Entomologist" and "American Entomologist and Botanist," of Saint Louis, were edited by Mr. Walsh, and Mr. C. V. Riley, the accomplished state entomologist of Missouri. These volumes will be often referred to, not only for the meritorious essays on injurious insects and for the excellent suggestions towards controlling these pests, but still more for the fearless and caustic manner in which the editors exposed many quack contrivances for exterminating our insect enemies; thus endeavoring to protect our too credulous farmers against the pretensions of ignorant inventors and shameless empirics.

Last to be mentioned, because the most recent, of the aids for the cultivation of entomology, and for popularizing the science, is the "Guide to the Study of Insects," by Dr. A. S. Packard, Jr.; a most judicious and excellent compilation from the best works on the various orders, adapted to the North American fauna, and illustrated with copious and well drawn original figures, combined

with no insignificant portion of the author's own investigations, chiefly in embryology.

Having now shown, by a hasty survey of the past, the gradual progress of our science, let us consult in regard to what is to be done to perfect the structure, the foundations of which are thus securely laid, and above all, what is necessary to popularize and utilize the great mass of information which has been obtained by so much labor.

Of all the branches of zoology, there is none more intimately connected with the great agricultural interests than entomology;* and yet from the vast number of objects involved in the study, many of which, on account of their small size, are with difficulty recognized by the untrained observer, and also from the complication of metamorphosis and habits such as are seen in no other department of the animal kingdom, there is no branch of natural history which requires for its elucidation greater industry, or higher powers of scientific analysis. For the same reasons, none of the inferior animals are so well fitted to elude and resist human control. We may therefore expect the practical application of the abstract truths and facts contained in the science to be a task of more than ordinary difficulty, requiring the assistance of the most learned students and the most ingenious investigators.

I may, perhaps, be accused of uttering a very vapid truism, when I assert that before any science is capable of rational practical application, the science must be well advanced, or at least its general principles and methods of investigation firmly established; and further that the application must be made by those who are fully informed as regards the science. Yet, by neglect of this apparent axiom, we have seen that the great state of New York expended a sum of money, almost sufficient to print all the useful books on entomology since published in the United States, upon one quarto volume, which is a monument only of presumption and ignorance.

I may be excused, then, for mentioning first those things which in my opinion will contribute to a more rapid advance in the de-

*"The entire sum expended by Congress, or by our various State Legislatures for this purpose (from 1776–1869) cannot exceed $90,000 to 100,000, or about $1,000 a year. Yet the annual damage done by insects within the limits of the United States cannot be less than ($300,000,000) three hundred millions of dollars. Am. Entom. and Bot. ii, 109.

"Napoleon, at the summit of his prosperity, never inflicted more damage on a nation than the liliputian insect army inflicts on the United States." *Ibid.*, ii, 367.

scriptive and systematic portions of our science, and conclude with those relating to its future usefulness.

First, then, will come the completion of the series of works, published by the Smithsonian Institution, on the classification of the several orders. For this students must be found, who will devote themselves to the study of those orders which have been heretofore neglected. This series must be supplemented by synonymical and bibliographical catalogues, and finally by synopses of species in each order to which supplements from time to time must be made, to diminish as far as possible the necessity of reference to other works, and thus place the accurate results of science within reach of persons who can ill afford the costly libraries now necessary for reference.

Second, and equally important, will be the formation of *type* collections for the identification of species. The number of species is so vast, the differences so small, and the multitude of new forms, not yet represented in collections, so great, that the best descriptions that can be written do not obviate the necessity of referring at times to the original types for comparison, and the amount of time, labor and expense saved to students, by having the whole of the information within reach at one place for each order of insects, can scarcely be estimated.

These type collections should be in the possession of the student who can make best use of them for the present interests of science, and on his death, or retirement from intellectual pursuits, should *not be exposed for sale*, or to any other vicissitudes of fortune, but should be given to his successor in science, or placed in some public institution where they will be *most carefully preserved* and *used only for reference*.

The liberality of friends, both at home and abroad, has already made my collection of coleoptera such a type collection, and with the exception of a moderate number of species described in Europe, of which no duplicates can be obtained, and a very small number which I have described from other collections, at the solicitation of their owners, it contains types of nearly all the described coleoptera of America north of Mexico. From the saving of time both to students who visit my collection, and to myself in naming series for correspondents, I cannot too strongly recommend the formation of similar collections in other orders of insects.*

*As a proof of the earnestness of this recommendation, as well as a duty I owe to those interested in the progress of the science, who have coöperated with me in plac-

The last portion of our subject yet remains to be discussed: the practical application of the great mass of scientific truth which has been thus far gathered in relation to the structure, classification, habits and life history of insects.

Of the immense number of insects which are found in any given portion of the earth's surface, comparatively few are capable of becoming so numerous as to affect plants injuriously. But from time to time, the interference of man in the progress of civilization destroys the balance which previously existed, and insects, before unimportant by reason of their comparatively small numbers, finding the checks to their increase removed, suddenly become very destructive to one or another of our agricultural products. In this case what is to be done? Obviously there are but two courses; the first to abandon the crop, until the insect enemy is reduced by starvation to its former insignificance; the other is to establish, by human intelligence, a system of checks to take the place of the divine machinery which has been interfered with by the same human intelligence. The second is the course that is, and probably will continue to be, generally adopted.

This new system of checks, according to the habits of the insect to be suppressed, may be divided into (1) those requiring personal labor and diligence alone; (2) personal labor assisted by contrivances; (3) automatic contrivances, not requiring personal attention (including the use of poisons); (4) the production of diseases; (5) the introduction of parasites and other enemies.

Under the 1st head may be mentioned the destruction of larvæ of borers by wires, etc.; 2nd, the collecting of plum weevils, potato chrysomelæ, etc., by large nets, and their subsequent destruction; 3rd, sugaring with poisoned food, specially applicable to nocturnal lepidoptera, and the use of fires, or lanterns with a vessel of poison, to attract nocturnal species; 4th, the communication of fungoid disease (like *pebrine*, which affects the silkworm) to other lepidopterous larvæ;* 5th, introduction and preservation of insectivorous mammals, birds, reptiles and insects

ing their types in my collection, I hereby pledge myself that my collection shall never be sold or divided, but that it shall be placed permanently, where it can be best cared for, and made accessible for the authentication of specimens. And I invite those who are willing to sacrifice rarities, or even uniques in their collections for such a purpose, to send them to me, with the full confidence that they are thus rendering them of more general use than they can be in local collections.

* I am extremely hopeful of the result of using this method. I have learned of an instance in which from the communication of the disease by some silkworms, the whole of the caterpillars in a nine-acre piece of woods were destroyed.

according to the particular indication of the case; and the transportation of parasites known to affect the pest in other localities.*

In the last annual report of Mr. C. V. Riley, Missouri state entomologist, there is a very effective comparison of the ravages made by the gregarious insect pests with the destruction caused by an invading army. The same simile has been frequently used by me in conversation, and has doubtless often occurred to many of you. The application of it made by Mr. Riley is that, if an enemy were to cause a small fraction of the injury which results each year from the depredations of even one of several of our insect enemies, the whole country would resound with a clamor for the suppression of the invaders. The memory of a colossal conflict is, alas! still fresh in our minds, and I desire not to awaken the painful recollections which rest in the bosoms of us all; but leaving out reference to the distressing scenes which we have all witnessed, there was much of the ludicrous, from which we may on this occasion derive profit, or at least the material for carrying our simile somewhat farther.

Putting out of view for the moment the noble patriotism of the uncorrupted and incorruptible masses of our nation, prominent among whom were the great agricultural class, whose interests it is the object of the present inquiry to protect, we all remember vividly the eager struggle of small politicians for staff appointments, of greater politicians, innocent of martial training, for higher commands; the zeal of contractors to furnish supplies for the soldiers in the field (sometimes, as in the case of shaving soled shoes, and shoddy garments, rather aggravating than relieving their sufferings); the general hurry and scurry, and bustle and turmoil, to do everything hastily and with the greatest pecuniary profit.

Why was all this? Was the great glory to be obtained in military service, when man fights man, the stimulus? Is there not equal glory in the more laborious, albeit peaceful combats of science, when man subdues the inorganic or the organic powers which resist his will, and make them subject to his control? Or is it, perhaps, to use a common phrase of the period, because there was money in it?

* I learn from the 3rd annual report of Dr. W. LeBaron, Illinois state entomologist, that in accordance with ideas first published by Mr. B. D. Walsh, a Chalcideous parasite of a coccus, which attacks the apple tree, has probably been successfully introduced into the northern part of the state, where it was previously unknown. (*Op. cit.* p. 200).

If the latter be a part of the cause of the agitation to which we allude, let us see if the same idea cannot be utilized for our present purpose. There is money, aye, much money, in any well devised scheme for the practical application of entomology to the protection of agricultural interests. First, there is the saving of untold millions in the productions of the country, now destroyed by insect pests. Second, there is the necessity for the expansion and reorganization of the Department of Agriculture, so that it will represent and protect the farmers, to the same extent that the Coast Survey protects the commercial interests of the nation.

In this expansion and reorganization of the Department of Agriculture the controlling power should be the highest scientific ability that can be procured for the place, and the office should cease to be as it has been since its establishment, a semi-sinecure for persons of small or local political influence. New places would have to be created, but with a moderate sprinkling of good working scientific men, many of these might be regarded like other offices, as the spoils of the dominant political party, and the interests of the farmer still be protected. Better would it be, though, if the latter class should demand that the government give them a thoroughly organized, compact, industrious body of the best trained scientific men, to teach them what should be done to control the destroyers of their labor.

There is now lying idle in Washington a great mass of notes on habits of injurious insects, collected by the untiring exertion of Mr. T. Glover, the industrious entomologist of the Department of Agriculture. This material, in its present imperfect form, if arranged under proper scientific supervision, and illustrated by figures submitted to judicious criticism, and then published in the same careful manner as the explorations of the Engineers, the Coast Survey, and other scientific departments of the government, would be of great utility in preparing the condensed reports, which should finally be accessible to every intelligent agriculturist.

One more illustration, and we will dismiss this already somewhat prolix simile of the invading army.

As in all such cases of aggression, it is competent with the higher military authorities to take private property for the benefit of the nation; so, too, a power similar in its results, though less despotic in its exercise, is necessary in our contests with the organic "powers of the air," which attack our fields. How this

authority is to be localized and manifested admits of much discussion, to enter upon which would tax your patience, and prolong this discourse far beyond the limits to which I intend to confine it. For the moment, the following may be suggested, with some modifications, as probably feasible in the extreme cases, fortunately few in number, which may be exemplified by such destructive attacks as the army or boll-worm upon cotton; the Hessian fly upon wheat; Scolytidæ (bark borers) upon pine forests; and the curculio upon plums and allied fruits.

The establishment of a fund, by the assistance of the federal government, state, or county authorities, or by private combinations, from which are to be paid owners of infected crops, which *are destroyed in order to prevent the spread of the infection.* This must of course be done under the advice of intelligent and carefully chosen agents of the authority by which the fund is to be dispensed. The rate of compensation could be easily determined at the end of the season by the average value or yield of similar crops in the vicinity, and should be such a liberal fraction of the full value, as would stimulate the owner of the property to be destroyed to declare the infection at the earliest possible moment, but at the same time not so large as to prevent due diligence on his part to confine the infection within the smallest limits.

Besides these two measures, which I consider of primary importance, there are several others, more easily under present control, by the adoption of which our accurate knowledge of the really formidable insect pests can be greatly increased, and the means for their suppression intelligently and efficiently applied. With a condensed statement of them, I shall conclude my discourse, thanking you for the kind attention with which you have favored me.

1. Reorganization of the Department of Agriculture, on a scientific basis, for the proper protection and advancement of agricultural interests.

2. Preparation of lists of the most destructive insect pests, with condensed notes of what is now known concerning them, that attention may be directed specially to those investigations necessary to complete our knowledge.

3. Coördination and coöperation of state entomologists with the chief of the Department of Agriculture, that they may work harmoniously and intelligently in concert, and thus avoid the waste

of labor now resulting from duplicate observations and repetitions in publication: collateral to this, the publication each year of a brief report containing such important advances made in the science, both at home and abroad as should be made known to the farmers.

4. Accurate calendars to be prepared of the appearance, disappearance and other phenomena of the history of the most injurious insects in different parts of the country.

5. Contrivance of apparatus on a large scale, by which, with the least expenditure of material and labor, the nocturnal species may be attracted by light, and dropped into a vessel containing cyanide of potassium or other poisonous substance.

6. Experiments on the effects of poisons upon the species, the habits of which permit the wholesale application of such means of destruction: especially adapted to nocturnal lepidoptera by the process known as sugaring for moths.

7. Careful study of epidemic diseases of insects, especially those of a fungoid nature: and experiments on the most effective means of introducing and communicating such diseases at pleasure.

8. The preparation by our best instructed entomologists working in concert, of one or more elementary books suitable for use in schools, giving in a compendious form the general principles of the science, and indications for applying the knowledge to practical results.

9. The appointment in agricultural colleges of competent professors of entomology, who have been trained in a scientific school, to fit them for the duty of instruction.

10. The establishment of the means of compensation for compulsory or voluntary destruction of crops infected by formidable pests, as above mentioned.

NOTES ON THE HONEY-MAKING ANT OF TEXAS AND NEW MEXICO.*

BY HENRY EDWARDS.

THE natural history of this very curious ant (*Myrmecocystus Mexicanus* Westwood) is so little known, that the preservation of

* Read before the California Academy of Sciences.

every fact connected with its economy becomes a matter of considerable scientific importance, and the following observations, gleaned from Capt. W. B. Fleeson of this city, who has recently had an opportunity of studying the ants in their native haunts, may, it is hoped, be not without interest.

The community appears to consist of three distinct kinds of ants, whose offices in the general order of the nest would seem to be entirely apart from each other, and who perform the labor allotted to them without the least encroachment upon the duties of their fellows. The larger number of individuals consists of yellow worker ants of two kinds, one of which, of a pale golden yellow color, about one-third of an inch in length, act as nurses and feeders of the honey-making kind, who do not quit the interior of the nest, "their sole purpose being, apparently, to elaborate a kind of honey, which they are said to discharge into prepared receptacles, and which constitutes the food of the entire population. In these honey-secreting workers the abdomen is distended into a large, globose, bladder-like form, about the size of a pea." The third variety of ant is much larger, black in color and with very formidable mandibles. For the purpose of better understanding the doings of this community, we will designate them as follows:

No. 1 — Yellow workers; nurses and feeders.

No. 2 — Yellow workers; honey makers.

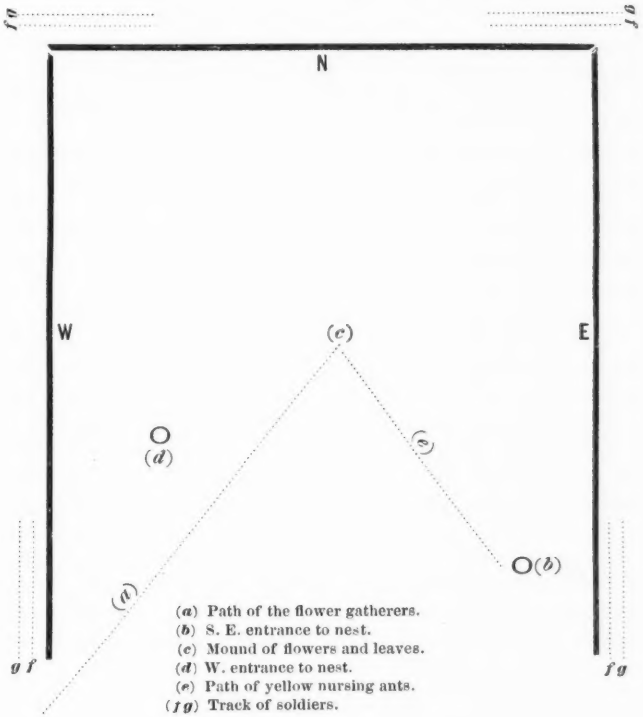
No. 3 — Black workers; guards and purveyors.

The site chosen for the nest is usually some sandy soil in the neighborhood of shrubs and flowers, and the space occupied is about from four to five feet square. Unlike the nests of most other ants, however, the surface of the soil is usually undisturbed, and, but for the presence of the insects themselves, presents a very different appearance from the ordinary communities, the ground having been subjected to no disturbance, and not pulverized and rendered loose as in the case with the majority of species.

The black workers (No. 3) surround the nest as guards or sentinels, and are always in a state of great activity. They form two lines of defence, moving different ways, their march always being along three sides of a square, one column moving from the southeast to the southwest corner of the fortification, while the other proceeds in the opposite direction. In most of the nests examined by Captain Fleeson, the direction of the nest was usually towards

the north; the east, west and northern sides being surrounded by the soldiers, while the southern portion was left open and undefended. In case of any enemy approaching the encampment, a number of the guards leave their station in the line and sally forth to face the intruder, raising themselves upon their hind tarsi, and moving their somewhat formidable mandibles to and fro as if in defiance of their foe. Spiders, wasps, beetles and other insects are, if they come too near to the hive, attacked by them in the most merciless manner, and the dead body of the vanquished is speedily removed from the neighborhood of the nest, the conquerers marching back to resume their places in the line of defence, their object in the destruction of other insects being the protection of their encampment, and not the obtaining of food. While one section of the black workers is thus engaged as sentinels, another and still more numerous division will be found busily employed in entering the quadrangle by a diagonal line bearing northeast, and carrying in their mouths flowers and fragments of aromatic leaves which they deposit in the centre of the square. A reference to the accompanying sketch will give a more clear understanding of their course: the dotted line (*a*) representing the path of this latter section, while the mound of flowers and leaves is marked (*c*). If the line (*a*) be followed in a southwest direction, it will be found to lead to the trees and shrubs upon which another division of the black workers is settled, engaged in biting off the petals and leaves to be collected and conveyed to the nest by their assistants below. On the west side of the encampment is a hole marked (*d*), leading down to the interior of the nest, which is probably chiefly intended for the introduction of air, as in case of any individuals carrying their loads into it, they immediately emerge and bear them to the common heap, as if conscious of having been guilty of an error. A smaller hole, near the southeast corner of the square, is the only other means by which the interior can be reached, and down this aperture, marked (*b*), the flowers gathered by the black workers are carried along the line (*e*), from the heap in the centre of the square, by a number of smaller yellow workers (No. 1), who, with their weaker frames and less developed mouth organs, seem adapted for the gentler offices of nurses for the colony within. It is remarkable that no black ant is ever seen upon the line (*e*), and no yellow one ever approaches the line (*a*), each keeping his own separate station and

following his given line of duty with a steadfastness which is as wonderful as it is admirable. By removing the soil to a depth of about three feet, and tracing the course of the galleries from the entrances (*b*) and (*d*), a small excavation is reached, across which is spread, in the form of a spider's web, a net-work of squares spun



by the insects, the squares being about one-quarter inch across, and the ends of the web fastened firmly to the earth of the sides of the hollow space which forms the bottom of the excavation. In each one of the squares, supported by the web, sits one of the honey-making workers (No. 2), apparently in the condition of a prisoner, as it does not appear that these creatures ever quit the

nest. Indeed, it would be difficult for them to do so, as their abdomens are so swollen by the honey they contain as to render locomotion a task of difficulty, if not to make it utterly impossible.

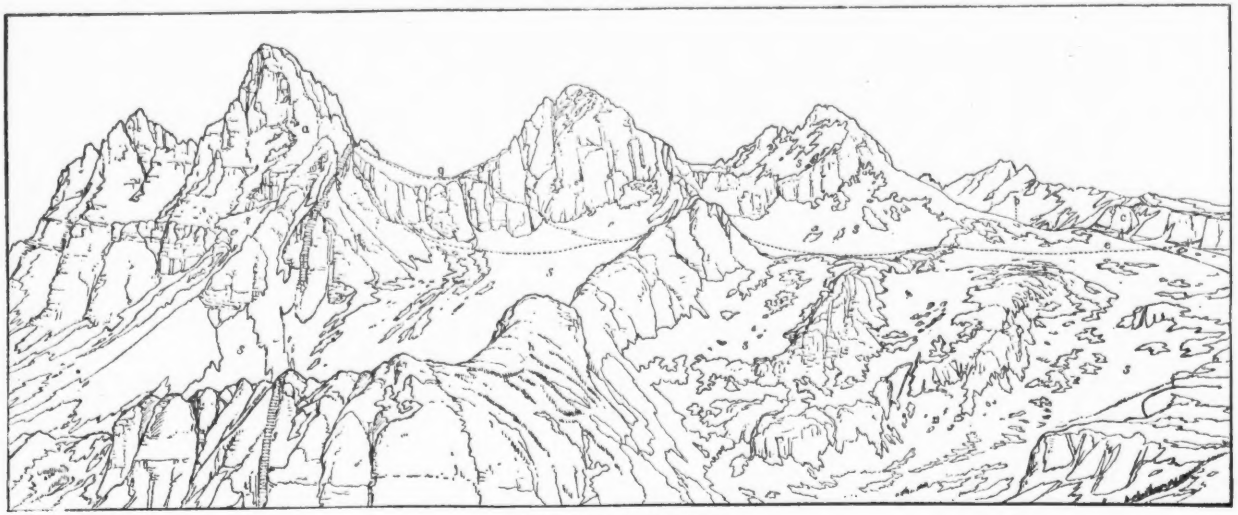
The workers (No. 1) provide them with a constant supply of flowers and pollen, which, by a process analogous to that of the bee, they convert into honey. That the remainder of the inhabitants feed on the supply thus obtained, though it is surmised, has not been established by actual observation; indeed, with reference to many of the habits of these creatures, we are in present left in total ignorance, it being a reasonable supposition that, in insects so remarkable in many of their habits, other interesting facts are yet to be brought to light respecting them. It would be of great value to learn the specific rank of the black workers (No. 3), and to know the sexes of the species forming the community, their season and manner of pairing, and whether the honey-makers are themselves used as food, or if they excrete their saccharine fluid for the benefit of the inhabitants in general, and then proceed to distil more. I regret that at this time I am only able to bring before the notice of the Academy, specimens of the honey-makers (No. 2), the other members of the community, except from Captain Fleeson's description, being quite unknown to me. It is, however, my hope that at a future meeting I may be enabled to exhibit the other varieties, and to give some more extended information upon this very interesting subject. The honey is much sought after by the Mexicans, who not only use it as a delicate article of food, but apply it to bruised and swollen limbs, ascribing to it great healing properties. The species is said to be very abundant in the neighborhood of Sante Fé, New Mexico, in which district the observations of Capt. Fleeson were made.

REVIEWS AND BOOK NOTICES.

THE SCENERY OF THE ROCKY MOUNTAINS AND ITS ORIGIN.—Professor Hayden's last report* on the geology of the territories

*Sixth Annual Report of the United States Geological Survey of the Territories, embracing portions of Montana, Idaho, Wyoming and Utah; being a report of progress of the explorations for the year 1872. F. V. Hayden, U. S. Geologist. Washington, 1873. With plates and woodcuts. pp. 844.

Fig. 175.



Three Tétons, looking East.

a, Mount Hayden; *b*, Lake; *c*, Quebec Group Limestone; *d*, Quartzite; *e*, Granite; *ff*, Trap Dyke; *g*, "Saddle"; *h*, Timber line, 9,000 ft.; Dotted line, course of ascent; *ss*, snow.

of Idaho, Montana and Utah comes to us stored with facts bearing upon the origin of the wonderful scenery of the Rocky Mountains. The mode of formation of the lofty peaks, of the vast abyssal cañons and broad lake valleys, together with the origin of the hot springs and geysers, the last remnants of the tremendous volcanic activity that pervaded this region, is discussed with more or less detail, by Prof. Hayden, whose sixteen years' experience as a geologist in the far west certainly enables him to speak with authority on these subjects.

One of the results of these surveys was the discovery and reservation of the National Park of the Yellowstone River. How tourists may enjoy its wonders and beauties will be solved, we are told, should the railroad which contemplates connecting Corinne, Utah, with Helena, Montana, pass up Henry's Fork. That accomplished, we are promised that "all the wonders of our great national park can be seen in one day's travel on horseback from this route."

We have before spoken in this journal of the fine photographs of the Téton Range published by the Survey. This group of peaks, which are more truly alpine in character than any other known in the west, have at length been ascended by Messrs. Stevenson and Langford, the only white men who have ever reached the summit. "Immense masses of snow and lakes of ice were found on its sides, and abundant signs of glacial action." The accompanying figure (175) gives an idea of the range and the course of ascent.

Another result of the season's (1872) work was the exploration and mapping out of the great water divide from which, in a radius of ten miles, the Missouri, the Green and Colorado Rivers, and the Snake and Columbia Rivers take their rise. A new geyser basin was discovered on Shoshone Lake, and found to be the true source of the Madison River, lying on the Pacific slope, between 7,000 and 8,000 feet above the sea, with surrounding peaks 10,000 to 12,000 feet high. The basin contained from seventy-five to one hundred springs, some being geysers of considerable power, while the peculiar ornamentation about them is considered more elaborate and interesting than the celebrated springs of the Fire Hole basin, an account of which we have already given our readers. These are the more prominent results of the season's work.

Of much economic interest is the great soft coal or lignitic formation of the west. From the researches of Messrs. Lesquereux, Meek and others, together with his own, Prof. Hayden infers that

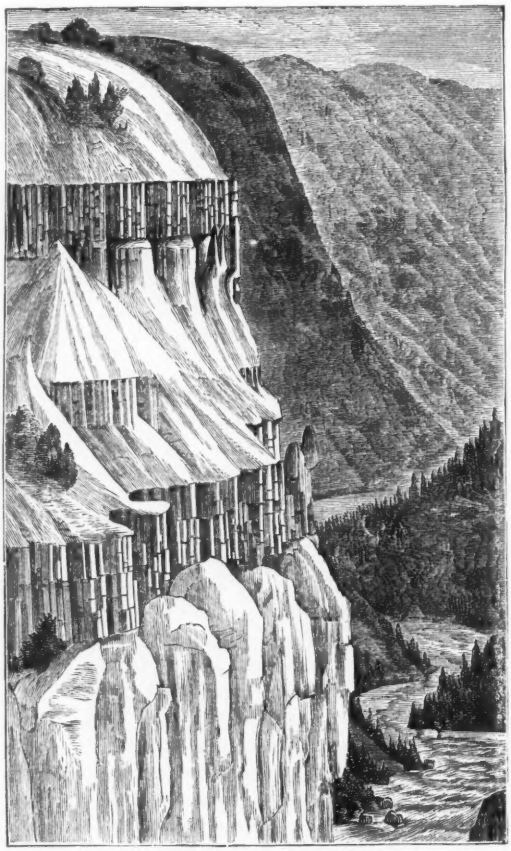
the deposition of these lignitic strata began during the latter portion of the Cretaceous period, and continued on into Tertiary times.

The origin of the Salt Lake valley, of which the remarkable Wahsatch Range forms the eastern boundary, seems due to a long continued erosion of a series of mountain chains spread over this area and resulting from a crumpling or folding of the earth's crust. "It is most probable that at a comparatively modern period the vast area between the Wahsatch Mountains on the east and the Sierra Nevada on the west was one great lake, the mountains rising up as islands in this vast inland sea. The lakes, large and small, which we find scattered over the basin at the present time, are only remnants of this former sea." Out of the flanks of these wrinkles in the earth's crust, cañons, with nearly vertical walls 1,000 to 2,000 feet high, have been carved by atmospheric agencies, such as ice, frost and water. "The valleys between these folds or ridges are synclinals, which have been deepened by erosion. The islands in Salt Lake are only the crests of these folds, while the waters occupy the synclinal valleys; and this remnant illustrates, on a small scale, the scenic beauty of the great inland sea when it extended over the entire basin."

Farther north in the Yellowstone valley are magnificent specimens of cañons whose mountain walls are formed of volcanic conglomerate 1,000 feet in thickness. Such a valley of erosion is represented by Fig. 176. In the mountains at the source of the East and Yellowstone rivers these conglomerates are sometimes 4,000 or 5,000 feet thick. These beds are supposed to have been "thrown out by volcanoes into the surrounding waters much as similar materials are injected from modern volcanoes at the present time." As these beds are horizontal and regularly stratified from base to summit, Prof. Hayden concludes "that at a comparatively modern date, the waters so covered these mountain ranges of the northwest, that not even the summits of the loftiest peaks were above the surface. It is barely possible that we might make an exception in the case of the Grand Tétons. We may suppose that the materials were supplied from the numberless volcanic fissures in unlimited quantities in a comparatively brief space of time; but the period which would be required for the waters to arrange this matter in the remarkably uniform and compact series of strata which we find at the present time must have been great.

The results have been carried on upon such a stupendous scale that the mind finds with difficulty the courage to grapple with them or attempt to explain them. And then, subsequent to the depo-

Fig. 176.

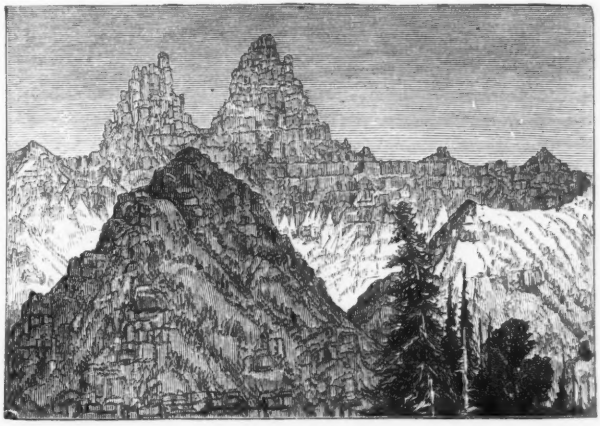


Basaltic Columns, Yellowstone, near mouth of Tower Creek.

sition of these enormous beds of conglomerates, has been the wearing out of cañons and valleys 2,000 to 4,000 feet in depth, the sculpturing of some of the most marvellously grand and unique

scenery on the continent. In passing up the valley of the upper Yellowstone, which is about three miles wide and has been carved out of this hard breccia, one could easily imagine himself in some enchanted land, where, on every side, were castles and palaces without number." Farther on our author concludes that "the erosive forces have acted on a more stupendous scale than he had ever before conceived of, and that the entire series of sedimentary strata, from the lowest Silurian to the highest Tertiary, known in the West, has extended in an unbroken mass all over the northwest; and we find here and there by the exposure of the entire series, as at Cinnabar Mountain, and in many other localities, the most satisfactory proof of the statement which I have so often made. This

Fig. 177.



Index and Pilot Peaks.

single statement implies that from 10,000 to 15,000 feet in thickness of unchanged rocks have been removed from this mountain region, except what might be called remnants left behind, occupying restricted areas."

The period of intensest volcanic activity culminated during the later Tertiary period. The mountains resulting have now assumed such forms as are shown in Fig. 177 of Index and Pilot Peaks, while Fig. 176 is an example of basaltic columns, the result of

overflows of lava, which forms the walls of the grand cañon of the Yellowstone.

The last trace of this volcanic activity, for there are now no active volcanoes in Montana or Idaho, is seen in the numerous hot

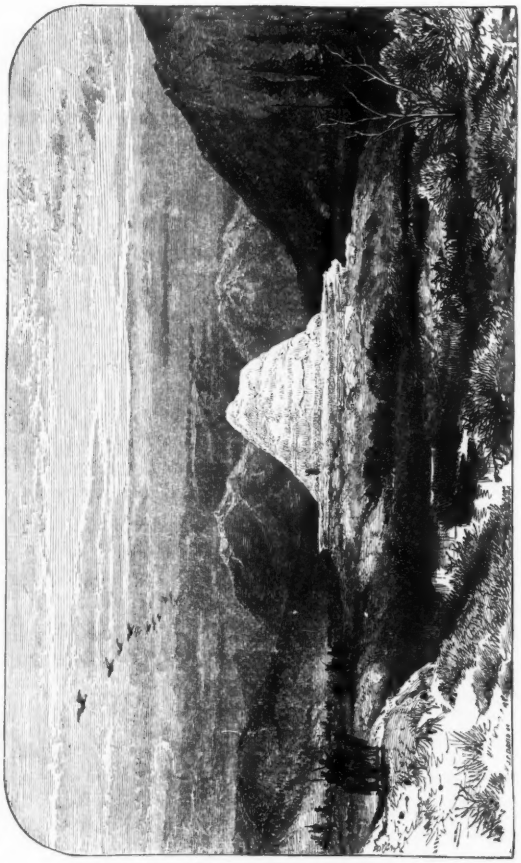


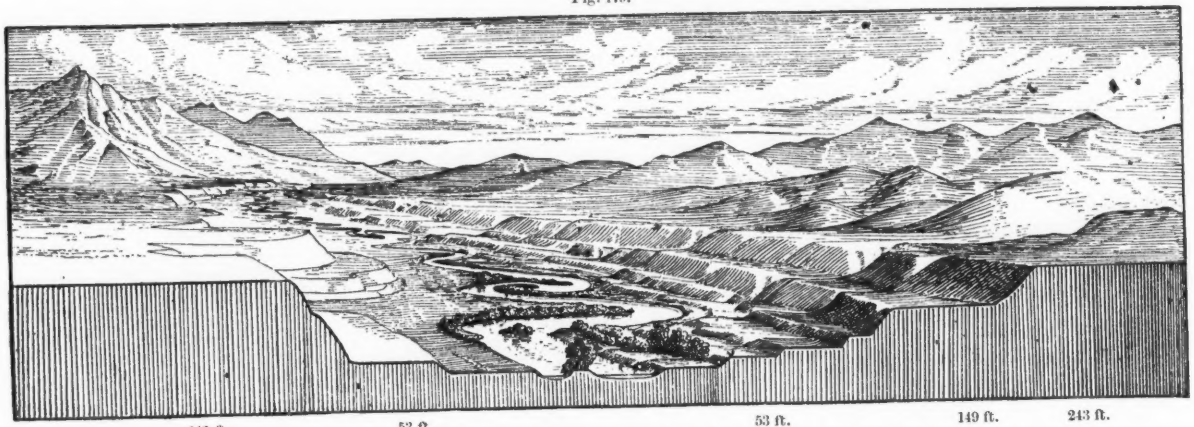
Fig. 178. Extinct Geyser, East Fork of the Yellowstone.

springs or extinct geysers, in the valleys, of which Fig. 178 represents a good example. How this region was drained we will answer in the author's own words.

"We may conclude, not only that the carving out of the channel of the Grand Cañon was a very modern event, but that the deposition of the entire material which forms the cañon is, in a geological sense, quite a modern occurrence. The drainage of the country commenced long before the excavation of the present watercourses, but it is difficult to answer the question how this great drainage was brought about, unless we account for it by a general elevation of the entire country, gradually sending this immense body of water, which must have prevailed all over the northwest at least, perhaps all over the Rocky Mountain region, westward into the Pacific and eastward into the Atlantic. As the waters slowly subsided they were separated into lakes of greater or less size, and then came the excavation of the Grand Cañon, which slowly drained the great lake-basin above the falls so that now we have only the comparatively small remnant, the Yellowstone Lake. Other small fragments are scattered about in the vicinity, which now form reservoirs for the local drainage. Undoubtedly the same series of remarkable physical events occurred in Oregon and California and in Idaho and Washington Territories, and, perhaps, far southward into Mexico, judging from the published reports. The Hot Springs, which are now slowly dying out, are, of course, the last of this series of events. The evidence seems clear that all over the West, during this great period of volcanic activity, the hot springs and perhaps even geysers were very numerous. We everywhere find the remains or deposits in all the states and territories west of the Mississippi, and now and then a warm or hot spring remains to indicate the story of their former power."

How these valleys were eroded may be inferred from the following remarks. "On the west side of the Madison there are three or four peaks which are at least 10,000 feet high. Among these mountain-gorges we see the sources of the myriad small branches which, in the aggregate, form the large river. Nestled among the craggy cliffs are here and there little ponds of clear water, derived from the melting of the snows, seldom ever seen except by the birds and the game that visit them to quench their thirst. The tendency of all these gorges is to work their way inward toward the divide. Great masses of snow and ice accumulate in them during the winter; and the water, flowing down among the fractured masses, freezes and expands with a force that year by year tears down a portion, which falls into the depths below and is swept down

Fig. 179.



Terraces, Valley of the Madison. (Elevations are given above water level of the river.)

by the torrent. The aggregate of the forces which have continued in operation through a series of ages, which no man can determine now, and which we agree to denominate meteoric or atmospheric, are the combined action of water, air and ice. These forces have undoubtedly been far more effective in ages past than at present."

One of the latest geological occurrences in this region, as well as over the world generally, is the formation of the terraces occasionally found bordering rivers. In a basin of the Madison River is a remarkable system of terraces represented by Fig. 179. While usually in the terraces of our eastern rivers, and in fact rivers generally, those on opposite sides are of unequal height, here each terrace is uniformly of the same height as the one opposite.

In Montana neither are the anticlinal folds or synclinal valleys so distinctly defined as in the interior basin of Utah, but the prominent features are the widely extended areas of elevation.

Geologists will be interested in a feature of the geological structure of the mountains of Montana, "observed by the survey of the past season for the first time and not noticed in such a marked degree in any other portions of the west." This is the inversion of the sedimentary beds, so that the oldest incline at a greater or less angle on those of more modern ages. The mode of formation of cañons and river valleys is reserved for future discussion, but attention is drawn to the "fact that the streams seem to have cut their way directly through mountain ranges, instead of following synclinal depressions." This, he says, indicates that they began the process of erosion at the time of the commencement of the elevation of the surface. "This is shown all along the valley of the Yellowstone and more conspicuously in the valleys of the Madison and Gallatin which have carved immense cañons or gorges directly through two of the loftiest ranges of mountains in Montana."

The action of glaciers in causing this erosion Prof. Hayden thinks to have been local, and he regards the superficial or drift deposits, which sometimes are very thick, as of local origin. "As I have so often stated in my previous reports, I have never been able to find any evidence in the Rocky Mountain region of what is usually termed a northern drift."

It will be seen how much geographers and geologists as well as lovers of the marvellous and beautiful in nature are indebted to

the liberality of our government in causing these explorations to be carried out, and in placing the results directly before the people. We shall return to this report in a subsequent number of this journal, and notice the results contributed by Prof. Hayden's collaborators.

After all, the discoveries here published are the results of but a slight reconnoissance, and we trust that this is but the beginning of a long series of annual explorations, so that the outlines here sketched may be filled in with a completeness worthy of the subject.

ELEMENTS OF PHYSICAL MANIPULATION.* — This book would, perhaps, have never seen the light, or even been conceived of in the olden time of endeavoring to instruct students by talking at them from behind a formidable array of retorts, balances and batteries. By the new method the student is invited into the laboratory, and initiated into the use of the apparatus, of old so mysterious and awe-inspiring to the beginner. The tools of the physicist and chemist are now explained and their use illustrated; and, equipped with a knowledge of manipulation, the learner needs little urging to apply his information.

This text book of physical manipulation seems admirably adapted to aid the teacher in work of this kind, and for those who have not the advantages of competent laboratory instruction it seems to us that it must prove invaluable. It is also admirably designed as an introduction to the ordinary text books.

Judging by the portion relating to the use of the microscope, the style is exact and clear. The spectroscope, both solar and chemical, is described, and experiments in its use given. So for the microscope. The instrument is described, and experiments illustrating its use given, also an account of the diaphragm, oblique illumination, the study of opaque objects, the lieberkuhn, Wenham's parabolic condenser, the achromatic condenser, the polariscope, binocular, Maltwood's finder, micrometer, goniometer, camera lucida, spectrum microscope, and test objects, together with concise directions for the preparation and mounting of objects, and directions for measuring the focal length of an objective.

Prof. Pickering claims that among the experiments, several that are new, with new apparatus, such as that for ruling scales, the

* Elements of Physical Manipulation. By Edward C. Pickering. New York. Hurd and Houghton. 1873. 8vo. pp. 225. $3.00.

photometer and the polarimeter, are for the first time described in this book. The typographical appearance of the book is most inviting, and we trust that the second volume, relating to heat, electricity and other subjects interesting to the student of physics, will soon appear.

THE SPECTROSCOPE.*—The time is perhaps coming when the scientific world will be divided into two classes, *i.e.*, those who carry a microscope, and those who carry a spectroscope in their vest pockets. For what biologist can do without his microscope, or physicist without his spectroscope? This little manual tells us what the spectroscope is, and how it has been applied in discoveries that have transcended the wildest dreams of philosophers. Mr. Lockyer tells the story with such perspicacity and interest that though we had intended to simply glance through its chapters, we have not failed to read every word of it. Admirably clear and comprehensive in style, it is beautifully illustrated and very attractive in typography. It is the first of a library of scientific manuals to be published by Messrs. Macmillan & Co., under the title of "Nature Series."

BOTANY.

SENSITIVENESS OF THE LEAVES OF DIONÆA AND DROSERA.—At the recent meeting of the British Association for the Advancement of Science Dr. Burdon Sanderson read a paper on the electrical phenomena which accompany the contractions of the leaf of *Dionæa muscipula*. The contraction of certain organs of some plants on irritation, such as the leaves of *Drosera* and *Dionæa*, especially the latter, strikingly suggest a correspondence of function between them and the motor organs or nervous system of animals. A careful series of experiments made by means of Sir W. Thomson's galvanometer, fully confirmed the hypothesis of the existence of voltaic currents in these parts; the currents being subject, in all respects in which they have as yet been investigated, to the same laws as those of muscle and nerve. At the same meeting a paper was also read by Mr. A. W. Bennett on the movements of the glands of *Drosera*. These glands, which fringe the margin of its

*The Spectroscope and its Applications. By J. Norman Lockyer. With colored plate and illustrations. Nature Series. London and New York, Macmillan & Co., 1873. 12mo pp. 117.

leaf and cover its upper side, have been shown by previous observers not to be hairs in the true sense of the term, *i.e.*, mere cellular expansions of the epidermis, but to be integral parts of the leaf, with a fibro-vascular bundle containing spiral threads (in other words a vein or nerve of the leaf) running through them, and even to be furnished with stomata. The glands excrete at all times when in a healthy condition a white viscous gluten which quickly entraps any small insect that settles upon the leaf, gradually holding it down more and more as it struggles, till escape is hopeless. The glands soon begin to move towards the imprisoned insect; but this movement is not very conspicuous at first, and is very much more decided after the insect has almost completely ceased its struggles; thus appearing not to be due to the existence of a "contractile tissue" in the leaf, which is irritated by the movements of the insect. After the lapse of some time the whole of the glands of the leaf, even those which were at a considerable distance from the insect, are found to be bending over towards it and to be almost in contact with it. After a time the insect is to all appearance digested, actually supplying the tissue of the leaf with nourishment. Very nearly the same effect was produced by substituting for the fly a piece of raw meat, the movement of the glands being somewhat slower, but ultimately almost as complete; the meat being apparently digested in the same manner. On other leaves were placed a minute piece of wood and a small piece of worsted; and in neither of these cases was the least change perceptible after a considerable time in the position of the glands or of the object itself.—A. W. B.

In this brief abstract Mr. Bennett does not mention that these movements are pretty well known of late years, since Mr. Darwin called attention to the subject. Indeed they are in this country recorded in elementary books and demonstrated to classes. Probably he is not aware that they were discovered, fully described, and their significance indicated, by Roth, a little less than a century ago. Even the folding over of the leaf, so as to enwrap the insect, to which Mrs. Treat of New Jersey called attention a year or two ago, was observed by Roth. It may now be stated that the remark, in "How Plants Behave," "if a particle of raw meat be substituted for the living fly, the bristles will close upon it in the same manner, but to a particle of chalk or wood they

remain nearly indifferent," was made upon Mr. Darwin's authority.—A. G.

VARIETY IN THE FORM OF FLOWERS IN THE SAME SPECIES.—Dr. Hermann Müller of Lippstadt has contributed to a recent number of "Nature" a remarkable paper in which he explains the existence of distinct forms and sizes of flowers, and even of distinct varieties within the same species, by their adaptation to the needs of the insects which are necessary to fertilize them, and which vary according to the position in which the plant grows. The plants especially brought forward by Dr. Müller as illustrations of this law are *Lysimachia vulgaris*, *Rhinanthus Crista-Galli* (including the variety or sub-species *R. major*) and *Euphrasia officinalis*. In each of these cases distinct varieties are well-known, and have even been distinguished by names, varying chiefly in the size and color of the petals, and the relative length of the style and stamens. These distinct varieties Dr. Müller states are generally found in very different situations, and are visited and fertilized by totally distinct insects, for which the construction of the flower is specially adapted. Those characterized by small pale colored flowers grow, as a general rule, in shady situations where they are comparatively little visited by insects, and are very commonly self-fertilized.—A. W. B.

COMPOSITION OF THE PUFF-BALL.—Prof. A. H. Church publishes in a recent number of the "London Journal of Botany," some analyses of the giant puff-ball (*Lycoperdon giganteum*), which resulted as follows:—

Composition of Lycoperdon giganteum.

	When fresh.	When dry.
Water,	90·89	
Fat, oil, and resinous matter,	·90	11·0
Albuminoids,	5·48	66·78
Cellulose or fungin, etc.,	2·10	14·78
Ash or mineral matter,	·63	7·44
	100·00	100·00

Composition of the Ash.

Phosphorus pentoxide,	46·19
Potash,	35·48
Soda,	6·95
Lime,	2·47
Ferric Oxide,	1·08
Silica,	·66
Other substances and loss,	7·17
	100·00

The noticeable points in these analyses are the very large proportion of phosphoric acid in the ash, and of albuminoids or nitrogenous substances in the fresh plant, the latter accounting for the very highly nutritive properties reputed to be possessed by the edible fungi.—A. W. B.

NESÆA VERTICILLATA.—Our species of this genus is somewhat curious. The flowers are dimorphous—Darwin says trimorphous.

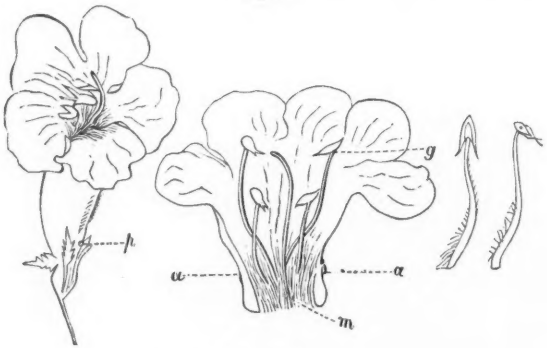
In one pond, or cluster of plants, I find the longer stamens about half the length of the style and twice the length of the shorter ones. In another the style is very short, not more than one-third the length of the shorter stamens, which, in turn, are about one-third as long as the longer ones.

But the root is, perhaps, more curious than the flowers, being very thick, sinuous and knobby, living and growing many years, hard and woody, the bark turning black when cut.— C. W.

CALYCERA BALSAMATIFOLIA.— The curious waif of ballast ground near Philadelphia, was determined by the discoverer himself, not by Dr. Leffman, as the latter informs us, at whose request we make the correction of the statement in the NATURALIST for October.

PERFORATION OF GERARDIA BY BEES (see p. 689).—We unfortunately omitted to insert the cut illustrating Mr. Bailey's article on p. 689. The accompanying figure (180) shows the flower as in

Fig. 180.



Gerardia perforated by bees.

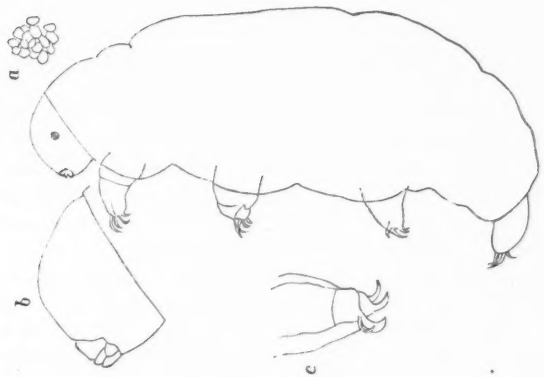
nature with the point of perforation (*p*); also with the corolla spread open, *a*, aperture; *g*, guiding lines; and a front and side view of a stamen.— EDS.

ZOOLOGY.

DISCOVERY OF A TARDIGRADE.— We are not aware that there is any published notice of the occurrence of tardigrades in this country though undoubtedly microscopists have observed them.

We received early in March of this year several specimens of Macrobiotus from Rev. W. R. Cross of New Gloucester, Maine, collected last autumn in water in which moss was growing. It is white, $\frac{14}{100}$ inch long, and has minute eyes composed of about ten irregular facets. There is a distinct under and upper lip to the mouth, and a pair of tubercles (palpi?). It apparently differs from *Macrobiotus Oberhauseri* Doyère (Annales des Sciences Naturelles, Ser. 2., Tom. 13., 1840), to which it is closely allied in form, by

Fig. 181.



Macrobiotus Americanus.

the claws being shorter and much more curved. It may be called *Macrobiotus Americanus* (Fig. 181 *a*, eyes; *b*, mouth; *c*, claws). We have also received drawings of another species of the same genus from Prof. C. E. Bessey, of Ames, Iowa. He writes us, May 6th, that it was "found in water containing fresh-water algæ, such as diatoms, desmids, etc." It is a longer, slenderer species than *M. Americanus*, and with apparently longer and straighter claws.—A. S. Packard, Jr.

Discovery of the Basal Joint of Legs of Trilobites.—I have secured the fine collection of Trenton fossils of Mr. E. D. Walcott of Trenton Falls. It is particularly rich in Trilobites. Among the most interesting specimens, Mr. W. called my attention to one which he was confident would settle the question of the presence or absence of legs in Trilobites. And truly there can be no doubt left upon this point. The basal articulation of

eight pairs of legs is distinctly seen on one side of two specimens of *Asaphus gigas*, in the same position upon the eight thoracic rings of the two specimens, and that position is strictly homological with the base of attachment of the limbs of Isopods. There is an impression for a ninth pair of legs on the inner surface of the posterior angle of the cheek.

This discovery shows more fully than is generally admitted, that trilobites are a synthetic type. At the same time it shows that the tendency is towards the Isopods.—L. AGASSIZ.

ANCON OR OTTER SHEEP.—Professor Huxley, in an article on the "Origin of Species" (Lay Sermons, pp. 254–298), makes mention of the otter sheep which originated on the farm of Seth Wright, near Charles River, Mass.

They appear to have been noticed by David Humphreys, F.R.S., and a skeleton of one was sent to Sir Joseph Banks in 1813. Huxley says Humphreys found it difficult to obtain a specimen at that date, and further says he "believes that for many years no remnant" of the breed "has existed in the United States." In this latter statement, quite fortunately, Prof. Huxley is mistaken. Otter sheep were raised till within a few years on the farm of Hon. William Hale of Barrington, N. H. Mr. Hale has now ceased to raise them, but his son, Hon. Thomas W. Hale, tells me that he saw a flock a few weeks since on the farm of Joshua R. Chesley of Barrington, N. H. He thinks that possibly they may be found in Chichester, N. H., as some were sold from the home flock a few years since to be taken to that town. Now here is a trail that some of our naturalists should follow out. If the otter sheep were of sufficient importance to science for Humphreys sixty years ago to go to great pains to procure a skeleton to send to England, and if they afford important data on the subject of the origin of species, as with Huxley they seem to do, it is time they were reëxamined by competent authority, and skeletons secured for our own museums.

The Messrs. Hale have a fund of information respecting these sheep, for they raised them for a quarter of a century. They secured their flock as the original one of Green was obtained, by selecting from the offspring of an otter ram and common straight-legged sheep. This ram was purchased at Sligo, in Somersworth, N. H. Connection could doubtless be made thence with the Seth

Wright stock. The facts connected with the breeding of this flock are substantially the same as those given by Huxley in reference to the Seth Wright flock.

Mr. Hale, senior, thinks the progeny of an otter ram with ordinary sheep were oftener straight- than bow-legged. Mr. T. W. Hale says that he is *sure* there were never any reversions to long and straight legs when they were breeding pure otter; and a farm boy's recollection on such a matter is pretty trustworthy. The Hales think the otters were not quite as prolific as the ordinary kind. There were some things about reproduction that indicated a feebler constitution than that possessed by other varieties. I am not an anatomist and can give a description of these sheep only in general terms. They came well enough by the term "otter." We used to call them "creepers," their bodies were so close to the ground. Mrs. Hale says they were a race of cripples, and that is probably the best general designation they could have. Their legs were short and very much curved or bowed outward. The flexure of the knee joint of the fore leg instead of being longitudinal with the axis of the body was at quite a high angle from it. In other words this joint instead of being a knee became an elbow joint. So it appeared. The joints were enlarged, the gait slow and laborious. If the case of the otter sheep has any bearing on the subject of the origin of species it certainly shows that differentiation may take place by degradation as well as by elevation. If some competent anatomist will take this matter in hand the object of this article will be gained. — C. Caverno, *Amboy, Ill.*

Crows and Ravens. — In the November number of the Naturalist, Dr. Barrett, after alluding to the supposed distinct geographical range of the crow and raven, asks whether there is any antagonism between them, and whether they ever exist together. From the abundance of the crow over the eastern portions of the United States, and the almost entire absence of the raven over the same region, and its abundance further west, where the crow is commonly believed to be of rare occurrence, it has been supposed that the two species do not mingle, and that an antipathy exists between them. This impression was shared by myself until the present season, when over a region nearly five hundred miles in breadth, in the territories of Dakota and Montana, I found the

ravens and the crows both frequent and breeding in the same forests, sometimes even within a few hundred yards of each other. Both species appear to occur together over a large portion of the region between the Missouri River and the Rocky Mountains, as Dr. Hayden speaks of both as "very abundant throughout the northwest,"* applying the same words to each. Along the Heart, Yellowstone and Musselshell rivers, the crow is much the more abundant of the two, but is more confined to the timber skirting the streams, where it may sometimes be met with in considerable flocks. The raven is more generally dispersed, and is as often met with far out on the barren treeless "divides" as elsewhere, seeming to delight even in the most desolate portions of the "bad lands."—J. A. ALLEN.

A NOTE PERSONAL.—Dr. Coues suggests, in the July NATURALIST, that there ought to have been some mention of "localities" in the Aiken-Holden list. Of course there ought, and there would have been, but for causes quite beyond control without a too long postponement of the publication of the paper. Both writers were nomadic, and all communication was interrupted. It would have been well, perhaps, to have stated the occasion of this omission in justice to Mr. Aiken. It was not necessary, however, for Mr. Holden, as his localities are given, with sufficient exactness, as in the immediate vicinity of Sherman. Dr. Coues thinks that mountain settlement "quite a long way from the 'Black Hills' as laid down on the maps." He may be right. Black Hills is about as vague a term as White-head, Long Island, etc. Nevertheless, when I was near Sherman five years ago, I was assured by the residents that I was in the very heart of the Black Hills. This, however, is not pertinent to the point. We know where Sherman is, and it does not matter whether the term is exactly right or not.—T. M. BREWER.

OCCURRENCE OF A DEEP SEA FLORIDAN CORAL NEAR CAPE COD.—Perhaps the most interesting discovery during the explorations of the deeper parts of the Gulf of Maine in the U. S. coast survey steamer "Bache" in September last, under the auspices of the U. S. Fish Commission, was that of a fragment of *Deltocyathus Agassizii* Pourtales. This occurred about twenty miles east of

* Trans. Am. Phil. Soc., Vol. xii, pp. 170, 171.

Cape Cod in 144 fathoms, soft mud, the temperature of the bottom being 39.°

This is a shallow, cup-shaped, small coral, remotely allied to Caryophyllia, and has heretofore only occurred in from 60 to 130 fathoms off the southern extremity of Florida, where it was dredged by Count Pourtales, to whom I am indebted for the identification. It will be remembered that Mr. Whiteaves dredged a species of Flabellum in the deeper parts of the Gulf of St. Lawrence summer before last. — A. S. PACKARD, JR.

THE MISSOURI SKYLARK. — In the November number of the NATURALIST Dr. Coues speaks of having met, the past season, with great numbers of the Missouri skylark (*Neocorys Spraguei*) on the prairies of the northern border of Dakota, referring to it, indeed, as one of the commonest species observed there. It seems, in fact, to be a common species over a wide area, as I had the pleasure of meeting with it myself, the past summer, from the Missouri River, near Fort Rice, to the Yellowstone, over much of which region it was quite abundant. It being a migratory species, leaving the plains of the Upper Missouri by the end of September, it seems stranger than ever before that a bird so numerous should have so long escaped observation, and that its winter quarters should still remain unknown.—J. A. ALLEN.

RANGE OF THE EARED GREBE. — Although this species (*Podiceps auritus* var. *Californicus*) is common along the Pacific coast of the United States in winter, it has not hitherto, to my knowledge, been found east of the Rocky Mountains in the United States, nor been known to breed anywhere within our limits. In July of this year I took several specimens in perfect plumage, at Turtle Mountain, lat. 49°, long. about 100° 30′, under circumstances which left no doubt of their breeding at this point. They were found on some of the numerous ponds about the foot of the mountain, in company with the common horned grebe (*P. cornutus*), the ruddy and various other ducks, all of which had young at the time.— ELLIOTT COUES.

SNOW BIRD.—Mr. W. H. Edwards writes us that in 1842 Mr. D. W. Marsh and himself found the nest and eggs of this bird on the summit of Graylock Mountain, and that he still has two of the nests collected at that time.

INFLUENCE OF LOCALITY UPON THE COLORS OF BIRDS AND ANIMALS. — Not being an ornithologist, I am unable to form an opinion as to the details of the observations given by Prof. Baird, Dr. Coues, J. A. Allen, R. Ridgway and others, in reference to the colors of our American birds. But the laws of variation so far proposed are obviously provisional only. Perhaps, therefore, another suggestion in the same direction may be allowed.

While in Egypt, in the winter of 1858–9, I was struck with the predominant *dulness* of hue of the birds and animals, wild and domestic. Of the latter, the cattle and buffaloes were nearly mud-colored; so were the sheep, and, preëminently, the numerous and miserable dogs. Nothing striking appeared in the aspect of the horses (sometimes white, mostly brown), or the more commonly used donkeys. The camel is always (in Egypt at least) a dull-colored animal.

But among the birds, myriads of which were seen by us on the Nile, between Cairo and Thebes, it can hardly have been an accident that in two months, I saw not one *bright color* of any kind. White is beautifully conspicuous in the ibis, which glistens in the sun as it flies; and a grayish white is usual with the very abundant, half-domestic pigeons. But the only other hues seen were gray, brown, dull yellow and (least often) black; in land birds as well as in ducks, geese, cormorants, pelicans, etc.

It is very probable that my scrutiny may have been quite incomplete, during the two months mentioned. It is, of course, possible also, that the summer fauna of Egypt may be entirely different, especially in its birds; although (as every one knows) the temperature is rarely as low as 40° or even 50° F. in the Egyptian winter, so far north as Cairo. Yet I cannot but think that a strong contrast must exist between that region (and probably Africa farther south, also) and South America, as well as the Indian peninsulas and archipelagoes, with their brilliant humming-birds, trogons and others of the West, and pheasants, birds of paradise, etc., of the Eastern Indies. With a still more restricted observation of them, I imagined, at least, a similar comparative rarity of brilliant hues among the insects of Egypt.

Towards the possible explanation of this peculiarity (if it be admitted) one suggestion, perhaps vague, has occurred to me; the question of the novelty of which concerns me less than that of its soundness. There is certainly nothing in the climate of any

part of Africa comparable to what is referred to in Prof. Baird's account (mentioned by Mr. R. Ridgway in AMERICAN NATURALIST, Sept., 1873) of the influence of the local circumstances, causing, in birds of the interior of western North America, "a bleached or weather-beaten appearance, possibly the result of greater exposure to the elements, and less protection by dense forests." Egypt has truly no forests; only thin groves of palms, doum trees, acacias, etc. Exposure to light is a characteristic of the country. But, apart from natural selection, or, indeed, it may be possibly *through* natural selection (in part at least),—is there not a proportion between chromatic variety of development and the *complication* of natural features of the country: *i. e.*, does not the most arid, least undulating, physically most monotonous region or continent present, with slender-leafed plants and non-umbrageous trees, the *minimum* of coloration of birds, reptiles and insects,—probably also of flowers? If this idea be trite, instead of novel, my apology for bringing it forward must be my failure to discern it precisely set forth in the papers of Dr. E. Coues, J. A. Allen and R. Ridgway, who appear to be conversant with what has been written upon the subject. Although Dr. Coues, for instance, distinctly states that "the maximum of brilliancy of color is reached in the tropics," its intensity varying "in direct ratio with the *temperature* and *humidity* of the breeding place," yet the *direct* influence of heat and moisture alone would seem to be here contemplated: while the manner of that influence remains yet to be explained. At all events I shall be glad if the mention of my brief observations on the poverty of coloration in the Egyptian winter fauna call out a statement upon the subject from some competent zoologist or ornithologist, both as to the facts and their theoretic explanation.—H. HARTSHORNE.

MIMICRY IN SNAKES. — A friend recently brought me from Florida a fine specimen of the banded water-snake (*Tropidonotus fasciatus*) which had been given him by a negro as one of the dreaded moccasons (*Ancistrodon piscivorus*). The resemblance was so perfect that I did not detect the error until I examined the head. I have since examined the specimens of this species in the Smithsonian collection and find that in many individuals the coloration imitates that of the moccason to perfection. It would seem that the species are not distinguished by the Florida people.

Is not this a fair case of protective mimicry?—G. BROWN GOODE, *Museum, Wesleyan University.*

NOTICE OF A RARE BIRD.—LeConte's bunting (*Coturniculus LeContei*) long remained among our special desiderata It was one of several species discovered by Audubon in 1843, on his memorable trip to the upper Missouri, the chief results of which were published in the appendix to the seventh volume of the "Birds of America." His type specimen, presented to Prof. Baird many years ago, having been lost or mislaid, as stated in Prof. Baird's work, the species rested upon the figure and description alone, until recently, when a specimen was received at the Smithsonian Institution from Texas, through Mr. G. E. Lincecum. This one was noticed in my late work (Key N. Am. Birds, p. 137). During the past summer I found the bird to be not uncommon at a certain point on the 49th parallel, between Turtle mountain and Mouse river, Dakota, where several specimens were secured. These represent the old and young of both sexes, and are particularly interesting on account of their showing that we have hitherto misapprehended the characters of the species. For Audubon's account, with which the Texas specimen agrees, indicates the extensively buffy, diffusely marked, soft plumage of the *young*, from which the adult differs materially. Some points of the case may be here presented. In form, the species differs notably from its congeners in the shape and greater relative length of the tail. This member is rather over two inches long, decidedly exceeding the wings, reaching considerably beyond the outstretched feet, and remarkably graduated, the lateral feathers being from $\frac{1}{3}$ to $\frac{1}{2}$ an inch shorter than the central pair. The tail feathers are all extremely narrow and acuminate—even more so than those of the sharp-tailed finch, *Ammodromus caudacutus*. The wings are very short and much rounded; when closed the primaries hardly exceed the longest secondary by $\frac{1}{4}$ inch, although the secondaries are not at all elongated. The bill is not so turgid as in *C. passerinus;* the younger birds have it smaller than it is in that species, as noted in the "Key;" the difference is not so great in the adults. Specimens measure from 4·90 to 5·10 in length, by 6·90 to 7·10 in extent; the wing 1·90 to 2·00, the tail 2·00 to 2·25. The general buffiness varies greatly in intensity and extent with age and wear of the plumage; it is greatest in birds of the year; an old male,

moulting, shows scarcely any. There is no yellow on the edge of the wing, nor a definite yellow loral spot, as in *C. passerinus*; there are no blackish maxillary or pectoral streaks as in *C. Henslowii*, the markings of the under parts of the adult being confined to sparse, sharp, blackish touches along the sides. In the younger birds, however, these may usually be traced across the breast, as is also the case with the young of *C. passerinus*, the adult of which is not, or not noticeably, marked below. But even the youngest specimen shows no maxillary streaks. There are some peculiarities in the shade and pattern of the variegation of the upper part; the markings of the adult being bold, sharply contrasted and heavily colored. The bill of the old bird is dark horn blue, lighter blue below; that of the young is reddish-brown, paler below. Feet flesh-colored at all ages.

I only noticed the birds on one occasion, August 9th, when a number were found together, in the deep green sea of waving grass that rolled over an extensive moist depression of the prairie. Five specimens were secured, in the course of an hour, not without difficulty; for, the grass being waist-high, the only chance was a snap shot as the birds, started at random, flitted in sight for a few seconds; while it was quite as hard to find them when killed. Several seen to fall were not recovered after diligent search. In their mode of flight, the birds resembled wrens; a simile which suggested itself to me at the time was that of a bee returning home laden with pollen; they flew straight, steadily and fast enough, but rather feebly, as if heavily freighted for their very short wings. The only note I heard was a chirring like the noise of a grasshopper. Although I found no nest, the circumstances of observation leave no doubt that the birds bred here. They were in company with a number of short-billed marsh-wrens; their neighbors of the drier prairie around were chestnut-collared buntings, Baird's buntings and Sprague's skylarks, all very numerous.—ELLIOTT COUES.

INSECT GALLS.—Mr. Riley is paying especial attention to galls and their architects. He has accumulated a vast amount of material, including all the described North American forms, with a view of soon publishing an illustrated work on the subject. He will be glad to receive assistance in the way of notes and specimens from the Un ted States and Canada, and will take pleasure

in properly acknowledging the same. Address Mr. C. V. Riley, St. Louis, Mo.

The Olive-sided Flycatcher. — The olive-sided flycatcher (*Contopus borealis*), though usually considered as a very rare bird, is quite abundant in some parts of Lewis, Herkimer and Hamilton counties in northern New York, where it breeds.

It is never found where there are no coniferous trees, and among them seems to have a decided partiality for old hemlocks. On the 12th of June, 1873, while hunting on Tug hill (Lewis Co.), I heard a bird utter a peculiar short whistle in a swamp directly ahead of me. I recognized the note as one I had heard in Idaho, but could not at once recall the species; so, guided by its oft repeated note, I entered the swamp and soon had the pleasure of seeing a fine olive-sided flycatcher perched on a dead limb on the top of a large hemlock. I shot this specimen, which proved to be an adult male in splendid plumage; I also succeeded in obtaining the female near the same spot.

At Big Moose lake, in Brown's Tract, they were quite numerous, and there we obtained several specimens (in July). They all seemed to have the same hab t of choosing a large hemlock tree with a few dead branches on top, and were sure to light on the uppermost twig. Their note, which is a short whistle, greatly resembles *O-wheo*, *O-wheo*, with the accent on the *whe*, and the voice falling at the last *o*. They sometimes repeat this note several times in succession, but generally not more than once or twice.

I was not so much surprised at finding this species breeding with us in Lewis Co., N. Y., because it is a very interesting locality for the ornithologist, and many rare northern birds are found there; but I must say I was surprised on September 10th, while hunting at Easthampton, Mass., at procuring a fine *Contopus borealis* in a small grove of pine trees within a mile of town. Since that date I have searched diligently for this bird in the same and similar localities about Easthampton, but as yet unsuccessfully. Has this species ever been obtained in Massachusetts before? — C. Harte Merriam, Jr.

Another Monster. — To the list given by me in the July number (page 435) must now be added a young cock, possessing a supernumerary wing, attached by ligaments to the ninth cervical vertebra, and hanging over upon the right side of the chest. It

was brought to me by Mr. C. B. Martin, of Tiffin, Ohio.—B. G. WILDER.

RANGE OF THE GEOCOCCYX CALIFORNIANUS.—I am advised, by letter from my friend, Dr. A. Woodhull, of the army, of the occurrence of this species on the Arkansas river near Ft. Lyon, Colorado, a fact which carries the known range of the species considerably eastward. Excepting Mr. C. E. Aiken's recent quotation from the mountains of Colorado (Proc. Bost. Soc., xv, 206), the U. S. record has hitherto been only from Texas, New Mexico, Arizona and California to the Sacramento valley. The bird appears to be rare in the locality, where my correspondent says only two or three were seen in the course of over two years. He says it is known as the "war bird" or "medicine bird," because prized by the Indians for its plumage, which is used to ornament their regalia of ceremony. —ELLIOTT COUES.

THE CARIBOU ON LAKE SUPERIOR.— During a recent visit (May 1873) to Isle Royale, Michigan (Lake Superior), interesting evidence of the former presence of the Caribou (*Rangifer Caribou* Aud. and Bach.), long extinct there, was brought to my observation. I have now in my possession two relics — the greater parts of the horns of this animal — which were picked up at different points on the island. The antlers are much decayed, one being a mere shell, and, beside, they had been gnawed by rodents. Such specimens, often of a great size, are frequently discovered of late at this isolated place.—HENRY GILLMAN, *Detroit, Michigan.*

CHIMNEY SWALLOW; CHANGE IN PLACE OF NESTING.— About June 15, 1871, a pair of chimney swallows (*Chætura pelasgia*) commenced building a nest in the barn in close proximity to the nests of the common barn swallow (*Hirundo horreorum*). The nest was finished by the 4th of July, and four eggs were laid. In 1872 there were two nests built in the barn, and this year two more were built, one of which I took down on July 8th and sent, with the four eggs which it contained, to the Peabody Academy of Science. The nest that I removed was replaced by a new one about the 20th of July. As this is a remarkable variation in the habits of the chimney swift, I send you this note with the nest. I shall watch for the appearance of the birds in the barn next year with interest. As they have now built in the barn for three

years, it seems as if the birds were finding out that the chimneys were no longer suitable places for rearing their young.—J. H. Sears, *Beverly, Mass.*

GEOLOGY.

The Fossils of Colorado.—The explorations this year have been more than usually productive of interesting results. The "bad lands" of Colorado have been discovered to be a graveyard of a long past period, distinct from that of Wyoming, and to contain the osseous remains of a great population of beasts, of totally different species and even orders from those of the latter age and region. They resemble more nearly those of the White River, of Nebraska, but many have been obtained by Prof. Cope not known there or elsewhere. So far he has proven the existence of more than one hundred species, some represented by thousands of individuals. Of these at least seventy species are new to science. They range from the size of the mole to nearly that of the elephant; sixteen species only are reptiles.

Many forms of insectivorous animals related to the mole, and of very small size, have been procured. The delicacy and minuteness of these fossils are surprising.

Gnawing animals, or rodents, left numerous remains of eighteen species, some not larger than the domestic mouse. Some were the predecessors of the rabbits, others of squirrels and others of mice.

Of cloven-footed quadrupeds a great many species have been found. Some were nearly intermediate in structure between the deer and the hog; like the latter, they had no horns; they were about as large as sheep. Others were about the size of gray squirrels, being the smallest of this class of animals ever discovered. Several species of horses were living during the same period, as is proven by the bones and teeth which have been discovered.

Their relative, the rhinoceros, abounded in Colorado, in former days, seven species having been procured by Prof. Cope. One of the specimens is a perfect skull, with teeth complete and covered with the moss-like crystallization seen in the moss agate. But the most remarkable monsters of the past, whose existence has been disclosed by the present survey, are a series of horned species related to the rhinoceros, but possessing some features in which, according to Prof. Cope, they resembled the elephant. They

stood high on the legs and had short feet, but possessed osseous horns in pairs on different parts of the head.

One of the largest species had a huge horn over each eye, while another had one on each side of the nose, and more than a foot in length, resembling those on the back part of the head of the ox, etc. A third one, of larger size than the last, had rudimental horns on the nose. Still another was about as large as the elephant. Its cheek bones were enormously expanded, and its horns were flat. A fifth species had triangular horns, turned outward. The first mentioned species has been named, by Prof. Cope, *Miobasileus ophryas* and the others have been placed in the new genus *Symborodon*. Their structure disproves entirely the statement of a recent writer that the presence of horns in pairs is an indication of relationship to the ruminating animals (oxen, etc.), for these beasts are quite near the rhinoceros.

Carnivorous species were not rare in this ancient family, and served as now to check their too rapid increase. Of the fourteen species known, there were tiger cats, dogs, hyænadons, and the new genus *Tomarctos*. It resembled a dog, and was as large as the black bear. Some of the cats had remarkably long canine or eye teeth. In a new species, the size of the panthers, these teeth greatly resembled those of a shark.

The reptiles embrace turtles, lizards and snakes, the last two orders discovered for the first time in this formation in America.

The forthcoming reports of Professor Hayden to the Secretary of the Interior will contain a full account of the discoveries in this interesting department of geological science, made during the progress of the survey from 1870 to the present time. Prof. Cope has obtained from the ancient sea and lake deposits of Kansas, Colorado, Wyoming, Idaho, etc., about 350 species of vertebrated animals, of which he has made known to science for the first time more than 200.

Paucity of Life in Oceanic Areas. — Prof. W. B. Carpenter concludes a recent article "On the Physical Conditions of Inland Seas," with the following remarks on the paucity of life in certain areas on the ocean bottom: —

"It is well known that a muddy state of the bottom water is unfavorable to the presence of animal life; and it has been particularly noted by Dana, that where such a sediment brought

down by a current is diffused over a part of a bed of living coral, it kills the animals of that part. Moreover, I learned at Malta that in the beds which yield the extremely *fine*-grained stone which is used for delicate carvings, scarcely any fossils are found save sharks' teeth; whilst in the *coarse*-grained beds of the same formation, fossils are abundant; and as the former may be regarded as the product of a slow deposit in the *deep* sea, so may the latter be considered as *shore* beds. Further, I have been informed by Professor Duncan, that in the Fleisch of the Alps, which shows in some parts a thickness of several thousand feet, and which is composed of a very fine sedimentary material, there is an almost entire absence of organic remains.

There is, however, another condition of the bottom-water of the Mediterranean, which is *not less* unfavorable than its turbidity —probably *yet more so*—to the existence of animal life in its depths; namely, the *deficiency of oxygen* produced by the slow decomposition of the organic matter brought down by its great rivers. According to the determination which I made in my second visit to the Mediterranean in 1871, the gases boiled off from water brought up from great depths contained only about 5 per cent. of oxygen and 35 per cent. of nitrogen, the remaining 60 per cent. being carbonic acid. Now in gases boiled off from the deep water of the Atlantic, the average percentage of oxygen was about 20, while that of carbonic acid was between 30 and 40; even this large proportion of carbonic acid not appearing prejudicial to the life of the marine invertebrata, so long as oxygen was present in sufficient proportion.

The *rationale* of both these conditions seems obviously the same;—namely, that in consequence of the uniformity of temperature of the whole mass of Mediterranean water below the surface stratum of 200 fathoms (which alone will be disturbed by wind, or be affected by the influx of rivers and of the Gibraltar current), there is *no thermal circulation;* the whole contents of the deeper part of this immense basin being thus in an *absolutely stagnant* condition. If the doctrine of a vertical oceanic circulation be true, every drop of ocean water is brought in its turn to the surface, where it can get rid of its carbonic acid, and take in a fresh supply of oxygen. But as the density of the surface stratum of the Mediterranean is never rendered greater by reduction of temperature, than that of the mass of water it overlies, there is no agency capable of producing any interchange; the bottom water charged with the slowly gravitating sediment is never disturbed; and the organic matter contained in that sediment consumes its oxygen so much more rapidly than it can be supplied from above by diffusion through the vast column of superincumbent water, that nearly the whole of it is converted into carbonic acid, scarcely any being left for the support of animal life.

These considerations, then, seem fully adequate to account for the paucity of life in the deeper part of the Mediterranean basin: and they will, of course, equally apply to the case of any other inland sea, so far as the same conditions apply. And it is not a little interesting to find that my old friend and fellow-student Edward Forbes was perfectly correct as to the limitation of animal life — so far as regards the Ægean Sea, in which his own researches were prosecuted — to a depth of about 300 fathoms; the error, which was rather that of others than his own, being in the supposition that this limitation applies equally to the great ocean basins, past as well as present. The researches in which it has been my privilege to bear a part have shown that *as regards the latter* there is probably no bathymetrical limit to animal life; while the results of my inquiries into the influence of the physical conditions of the Mediterranean, in limiting the bathymetrical diffusion of its fauna, will not, I venture to hope, be without their use in geological theory."

THE CONNECTICUT VALLEY IN THE HELDERBERG ERA. — Prof. Dana states in an article in the "American Journal of Science and Arts" for November, that the observations of Hitchcock and Percival, with his own, lead towards the view that in the Helderberg era the Connecticut valley, through its whole length from north to south, was a wide crinoidal and coral growing sea, separating eastern from western New England.

ANTHROPOLOGY.

INDIAN ROPE AND CLOTH. — The *Apocynum cannabinum*, Indian hemp, or silk plant, as it is sometimes called, is very extensively used by the Indians of Arizona for the manufacture of twine and cloth. The bark of the plant is tough and strong and something like flax. The Indians cut the plant when ripe and rub it so as to separate the fibres, with which they make very strong and beautiful fishing lines, and a fine thread which they use in sewing and also make into cloth. In the Department of Agriculture, there is a fine specimen of rope made of this fibre by the Ute Indians, which I obtained from them and presented to the Department. In the Smithsonian Collection there are also good specimens of strings and a fishing net made of this plant by the Indians of Arizona. Near Camp Lincoln in Arizona we obtained, from some old Aztec ruins, cloth that had been manufactured by hand from this plant.

The root gives out a very bitter milky fluid that is used as a medicine by the Indians. — DR. EDWARD PALMER.

An Error Corrected.— During the past summer and autumn many western and perhaps some eastern papers contained accounts of the discovery of a human skull in the carboniferous limestone of southern Kansas, by one of the instructors at the Catholic Osage Mission in that state. Its determination as a cranium reposed on the authority of a physician of the town. Deeming the statement to be incredible, some later newspaper article asserted the specimen to be the skull of a deer. As this determination is not more reasonable than the first, I requested some photographs, which were obligingly sent by mail. These representing an object very much like a human cranium, I determined to visit the Mission. On reaching it I was kindly shown the specimen by Father Schumacher, the principal. It proved to be the broad body-whorl of a large cephalopod shell, allied to *Goniatites*. Some specimens exhibited with it as petrified portions of a hay-stack which had been long exposed, were fragments of some kind of slag.—E. D. Cope.

MICROSCOPY.

Exudations of Diphtheria and Croup. — Dr. Jabez Hogg, President of the (London) Medical Microscopical Society, in a recent communication to that society, combats the somewhat prevalent doctrine that diphtheria and croup are essentially the same disease. From the bold assertion that nothing but a "clinical tradition" separates these two diseases, and from the contradictory evidence of clinical medicine, he turns to histological anatomy for a solution of the difficulty, and maintains that a sharp line can be drawn between the diphtheritic membrane and the croupous cast. The former he finds a dense, compact, opaque, felt-like membrane, firmly adherent and not removable spontaneously, which when forcibly detached comes away in fragments and leaves a broken and bleeding surface. This membrane, under a microscopical power of × 350, is seen to consist of fibrous and connective tissue, shrunken and compressed cells (epithelial, muscular, glandular, and even cartilaginous), fat molecules, muco-purulent or glandular corpuscles, crystals, starch granules, fungus spores, and other foreign bodies. On the other hand the croupous cast is a delicate, semi-transparent, often gelatinous exudation, not so intimately connected with the subjacent mucous membrane but that it is easily separable as an imperfect cast which is often thrown off during a fit of coughing. Under the same magnifying

power it is found to consist of pavement and ciliated columnar epithelium and a homogeneous, transparent, albuminous substance, (never truly fibrous) entangling detached epithelial cells or their contents, fat, mucous corpuscles, and a few foreign bodies. These casts rarely contain fungus spores; continue probably to be thrown off soon after their formation; and appear to partake rather of the nature of an excessive cell proliferation than of a true exudation: they are essentially an epithelial layer cast off and resembling the skin shed by some of the lower animals.

On the other hand, Dr. Bruce and Mr. Golding Bird stated that they had never noticed epithelium in the croup membrane, but that they had observed an infiltration of exudation cells (white blood corpuscles).

"Unusable" Objectives.—Mr. Henry U. Janson writes to the "Monthly Mic. Journal" proposing the wet front, or "aquatic nozzle" as a cure for "unusable sixteenths" and other objectives whose angular aperture has been increased at the expense of working focus until they can no longer come within reach of a large proportion of mounted objects. Being accustomed to work upon diatoms with a moderate angled $\frac{1}{16}$, he was induced to procure an improved lens of the same power, but 175° angle. This "tremendous 175°" performed beautifully upon all that it could reach, but about half his extensive collection of diatoms was out of its reach by reason of thickness of cover-glass; and all his high power objects have long been labelled "$\frac{1}{16}$" and "O. $\frac{1}{16}$" to indicate whether the new or the old sixteenth should be used upon them. Finally, having his new $\frac{1}{16}$ changed into an immersion he found that not only was the brilliancy of its performance increased and its power raised to about $\frac{1}{20}$, but that its focus was so much elongated that all his O. $\frac{1}{16}$ objects became perfectly usable. The comparatively long working focus of immersion lenses is a convenience well known and appreciated, but it has not, perhaps, been hitherto so formally recommended as a cure for the (also well known) "unusable" dry lenses of large angle.

Mounting in Balsam.—Mr. C. L. Jackson mounts his balsam objects in a chloroformic solution of balsam, and, after the air bubbles have all escaped, bakes them for about two days upon the flat top of a copper or tin box about a foot square and two and a half inches deep, and filled with water which is kept by means of

a gas flame at nearly a boiling temperature. For keeping the cover in position while the balsam is hardening, he finds the spring clip troublesome and uncertain, and substitutes shot or bullets, of different sizes according to the pressure required, laid upon the cover glass. The bullets are previously flattened by a blow from a hammer. [The conical rifle-balls which the writer has used for the same purpose are exceedingly convenient.]

PRESERVING TUMORS, ETC., DURING TRANSPORTATION.— Dr. J. G. Richardson recommends the popular mounting medium, a saturated solution of acetate of potash, as a temporary preservative of urinary deposits or other pathological specimens that are to be transmitted by post. Sections of tumors or of other tissues may often be prepared by soaking in this solution for two days. They are then to be removed from the solution, without much squeezing, and placed in a piece of india-rubber tubing, or wrapped up in sheet rubber or oiled silk, with the ends firmly tied, and mailed in an ordinary letter, the deliquescent fluid with which the tissue is saturated preventing alike the decomposition or desiccation of the object.

AMPHIPLEURA PELLUCIDA AS A TEST OBJECT. — Mr. Louis H. Noe, of Elizabethtown, N. J., has resolved this object, both dry and in balsam, with sunlight, through the ammonio-sulphate cell condensed obliquely with a small $2\frac{1}{2}$ inch lens, with all of the following objectives: — R. & J. Beck's $\frac{1}{40}$ dry, $\frac{1}{70}$ wet; Powell & Lealand's $\frac{1}{25}$, $\frac{1}{75}$, $\frac{1}{8}$ dry, $\frac{1}{16}$, $\frac{1}{8}$ wet; Wales' $\frac{1}{75}$ wet; Gundlach's $\frac{1}{24}$ (No. viii) wet; Hartnack's $\frac{1}{75}$ (No. x), $\frac{1}{72}$ (No. ix) wet; Tolles' $\frac{1}{70}$ dry, $\frac{1}{70}$, $\frac{1}{6}$ (130°) wet; and Spencer's $\frac{1}{4}$ wet.

NOTES.

THE Yellowstone Expedition, Gen. D. A. Stanley commanding, arrived at Fort A. Lincoln, D. T., September 22d, having passed a little over three months in active operations in the field, and accomplished a march of nearly one thousand miles through a region previously but very imperfectly known. The expedition left Fort Rice, D. T., June 20th, and arrived at the Yellowstone, a few miles above Glendive's Creek, July 15th. Crossing the Yellowstone at this point, the expedition proceeded up the valley of the Yellowstone as far as Pompey's Pillar, two hundred miles

above Glendive's Creek and about three hundred and fifty miles above the mouth of the Yellowstone. From Pompey's Pillar the expedition marched westward to the Musselshell, striking this river near the 109th meridian. Descending the Musselshell to the Big Bend, the course was thence eastward to the Yellowstone, which was reached at a point about seventy-five miles below Pompey's Pillar. The route thence homeward was essentially the one pursued on the outward journey.

The general object of the Expedition was successfully accomplished, and much general information respecting the country was obtained; considerable collections were also made in nearly all departments of natural history. The scientific corps attached to the expedition consisted of J. A. Allen, of the Cambridge Museum, in charge of recent and fossil zoölogy and botany, Dr. Nettre, mineralogist, E. Konopicky, artist, W. R. Pywell, photographer, and C. W. Bennett, taxidermist. The country visited afforded only the usual limited variety of animal and plant life characteristic of the drier portions of the plains, and the geological features presented an almost equal uniformity. The region traversed is embraced almost wholly within the great so-called "lignite tertiary basin," but contains also here and there little insular areas of upper cretaceous strata. The whole series of beds are hence below those so rich in fossil vertebral remains that occur so abundantly a few hundred miles further south; hence the fossils obtained were almost wholly molluscan, with a few imperfectly preserved remains of plants. The rapidity and great length of the marches the expedition was compelled to make, together with the proximity of hostile Indians, prevented so thorough an exploration of the country as was desirable, yet a large amount of information was gathered in respect to the topography of the region traversed, and its natural productions and resources, which is to be embodied in reports to the Secretary of War.

We have already recorded the gift to Prof. Agassiz of $100,000 from his son-in-law, Mr. Shaw. This sum is to be expended in enlarging the collections of the Museum of Comparative Zoology, as it is to be hoped that the state of Massachusetts will pay for the enlargement of the buildings. With this sum have already been purchased the Watchsmuth collection of western crinoids, including 400 species of the Carboniferous age in a beautiful state

of preservation, 170 being types of figures published in western geological reports; a large collection of trilobites from Trenton Falls, N. Y.; 2,500 skeletons from Prof. Ward of Rochester; Dr. Klumzinger's collection of fishes from the Red Sea; the Moesch collection of Jurassic fossils; a large collection of Pacific coast insects; the types of Loew's American Diptera, an exceedingly valuable collection; and Gulick's collection of Sandwich Island shells. Meanwhile the new rooms in the museum are nearly ready for the exhibition of specimens.

The forty-third meeting of the British Association for the Advancement of Science was held at Bradford. Dr. Joule had been elected President for this meeting, but owing to ill health he was unable to be present, and Prof. A. W. Williamson presided and delivered an admirable inaugural address. With either this or Prof. Allman's philosophical and profound address before the Biological Section, we wish we could say the address of the President of the American Association compared favorably. Neither in the method of treatment nor in its spirit or style did the American production do credit to the occasion. In another number we shall make liberal extracts from Prof. Allman's address. The Association meets next year at Belfast, Ireland, Dr. Tyndall presiding.

A Meeting of the National Academy of Sciences was held October 28th and 29th, 1873, in New York City. The following papers relating to biology were read: — "Results of explorations of the deeper portions of the Gulf of Maine with the dredge," by A. S. Packard, Jr; "On the distribution and primitive number of spiracles of insects," by A. S. Packard, Jr.; "Cycles of deposition in American sedimentary strata," by J. S. Newberry; "On a new method of analysis of composite sounds, and on experiments elucidating Helmholtz's hypothesis of audition," by A. M. Mayer; "On the relations of the different classes of vertebrates," by Theodore Gill; "Biographical memoir of the late Prof. J. F. Frazer," by J. L. LeConte.

We are requested, by Dr. Coues and Mr. Ridgway conjointly, to state that neither of these gentlemen "desires to continue a controversy of no scientific consequence, and one which, furthermore, has lost its personal interest since a mutual misunderstanding in

which it arose has been explained to their entire satisfaction." Mr. Ridgway further desires us to state that "he is willing to retract the implication of bad faith on the part of Dr. Coues."

THE meeting of the French Association for the Advancement of Science was held at Lyons from the twenty-first to the twenty-eighth of August, under the presidency of Prof. Quatrefages. The sections were fifteen in number, comprising among others Agriculture and Medicine. There were excursions down the Rhone, and to Geneva, with other entertainments.

THE new building of the Indiana State University at Bloomington, which is to be used principally for a museum, will be completed next month, and the Owen collection of between eighty and ninety thousand specimens, purchased by the trustees of the university three years ago, will be arranged at once. This collection contains, it is said, a nearly perfect skeleton of the Megatherium and many other rare and valuable specimens. The trustees have also just purchased a full series of casts from Prof. H. A. Ward of Rochester, at an expense of about $7,000, which will also be at once arranged in the new museum.

WE learn from "Nature" that Prof. Planchon has been charged by the French government with the duty of visiting America to study the ravages of the new vine disease occasioned by the plant louse, *Phylloxera vitifoliæ*.

M. COSTE, known by his elaborate work on embryology, and more recent experiments in fish raising, lately died in Paris, aged sixty-six.

PROF. CZERMAK, the physiologist, died in Leipzig Sept. 16th.

ALBANY HANCOCK, the distinguished English anatomist, died Oct. 24th.

AMONG Macmillan's recent announcement of new books, are the following: Cave Hunting; Researches on the Evidence of Caves respecting the Early Inhabitants of Europe, by W. Boyd Dawkins; The Physiology of the Circulation in Plants, in the lower Animals and in Man, by J. Bell Pettigrew; The Origin and Metamorphoses of Insects, by Sir John Lubbock, and the Elements of Embryology, by Michael Foster. Mr. R. Hardwicke announces Man and Apes, by St. George Mivart.

BOOKS RECEIVED.

Acrididæ of North America. By Cyrus Thomas. (From Report of the U. S. Geological Survey of the Territories.) 4to. pp. 262. With plate. Washington. 1873.

Synopsis of New Vertebrata from the Tertiary of Colorado obtained during the summer of 1873. By E. D. Cope. (From the seventh Annual Report of the U. S. Geological Survey of the Territories.) 8vo. pp. 19. Washington, Oct., 1873.

Report of the Director of the Central Park Menagerie, Department of Public Parks, City of New York, for the year ending May 31, 1873. 8vo. pp. 33. New York, 1873.

Annales de la Societe Entomologique de France. Serie 5; Tome ii. 8vo. pp. 694. 16 pls. Serie 4; tome x, cahier 2. 8vo. pp. 128. 6 pls.; cahier 3. 8vo. pp. 144. 8pls. Paris, 1872.

Bulletin de la Societe Imperiale des Naturalistes de Moscou. Annee 1872. No. 4. 8vo. 3 pls. Moscou, 1873.

Jahrbuch der Kaiserlich-koniglichen geologischen Reichsanstalt. Band xxiii. No. 1. Plates 1-4. 8vo. Wien, 1873.

Verhandlungen der k. k. geologischen Reichsanstalt. 8vo. Nos. 1-6. Wien, 1873.

Nuovo Giornale Botanico Italiano. 8vo. Vol. i. 13 plates. 1869. Vol. ii. 8 plates. 1870. Vol. iii. Nos. 1-3. 7 plates. 1871. Firenze.

Bulletin Mensuel de la Societe d' Acclimatation. 8vo. Series 2. Nos. 1-4. Paris, 1873.

Memoires de la Societe Royale des Sciences de Liege. 8vo. Serie 2. Tome iii. 6 pls. Liege, 1873.

Diptera Americæ septentrionalis indigena. By H. Loew. 8vo. pp. 300. Berolini, 1865-1872.

Biologie der Kalkschwamme (Calcispongien oder Grantien). By Ernst Haeckel. 8vo. Berlin, 1872.

Zeitschrift fur Akklimatisation. 8vo. Jahrgang ix. Nos. 7-12. 1871. Jahrgang x. Nos. 1-12. Berlin, 1872.

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Om Lovene for Vandets Bevægelse i Jorden. Af A. Colding. 4to. 2 plates. (From Vidensk. Selsk. Skr., 5 Række, Naturvidenskabelig og Mathematisk Afd., ix. Bd. 8). Kjobenhavn.

Krystallografisk-optiske Undersogelser, med særligt Hensyn til isomorfe Stoffer. Af Haldor Topsoe og C. Christiansen. 4to. (From Vidensk. Selsk. Skr., 5 Række, Naturvidenskabelig og Mathematisk Afd., ix Bd. 9.) Kjobenhavn.

Forgreningsforhold hos Fanerogamerne, betragtede med særligt Hensyn til Klovning af Nækspunktet. At Eug. Warming. 4to. 11 plates. (From Vidensk. Selsk. Skr., 5 Række, Naturvidenskabelig og Mathematisk Afd. 10 de Bind. 1. Kjobenhavn.

Thermochemiske Undersogelser. Ved Julius Thomsen. 4to. (From Vidensk. Selsk. Skr., 5 Række, Naturvidenskabelig og Mathematisk Afd., x Bd. 2. Kjobenhavn.

Memoires de l'Academie Royale des Sciences, des Lettres et des Beaux-arts de Belgique. Tome xxxix. 4to. Bruxelles, 1872.

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Observationes des Phenomenes Periodique des l' Academie Royale de Belgique pendant l'annee 1870. 4to. pp. 59. (Extrait du tome xxxix des Memoires.)

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Annuaire de l' Academie Royale des Sciences, des Lettres et des Beaux-arts de Belgique. 12mo. 38me Annee, 1872; 39me Annee, 1873. Bruxelles.

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Grevillea. London, Nov., 1873.

INDEX TO VOLUME SEVEN.